FINAL INTERIM MEASURE/INTERIM REMEDIAL ACTION FOR THE ORIGINAL LANDFILL (INCLUDING IHSS GROUP SW-2; IHSS 115, ORIGINAL LANDFILL AND IHSS 196, FILTER BACKWASH POND)

March 10, 2005

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ACRONYMS AND ABBREVIATIONS

AAESE	Accelerated Action Ecological Screening Evaluation
AHA	Activity Hazard Analysis
AL	action level
ALF	Action Levels and Standards Framework for Surface Water, Ground Water, and Soil
Am	americium
AOC	Area of Concern
APEN	Air Pollutant Emission Notice
AR	Administrative Record
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
BMP	best management practice
BZ	Buffer Zone
CAD/ROD	Corrective Action Decision/Record of Decision
CAQCC	Colorado Air Quality Control Commission
CCR	Code Colorado of Regulations
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CHWA	Colorado Hazardous Waste Act
CID	Cumulative Impacts Document
CMS/FS	Corrective Measures Study/Feasibility Study
COC	contaminant of concern
CRA	Comprehensive Risk Assessment
cy	cubic yard
DOE	U.S. Department of Energy

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ACRONYMS AND ABBREVIATIONS

DOI	U.S. Department of Interior
DQO	data quality objective
ECOC	ecological contaminant of concern
EPA	U.S. Environmental Protection Agency
ERA	Ecological Risk Assessment
EU	exposure unit
FIDLER	Field Instrument for the Detection of Low-Energy Radiation
FY	fiscal year
GIS	Geographic Information System
HAP	hazardous pollutant
HASP	Health and Safety Plan
HPGe	high-purity germanium
HRR	Historical Release Report
IA	Industrial Area
IABZSAP	Industrial Area Buffer Zone Sampling and Analysis Plan
ICP/MS	inductively coupled plasma mass spectrometry
IDL	instrument detection limit
IGD	Implementation Guidance Document
IHSS	Individual Hazardous Substance Site
IM/IRA	Interim Measure/Interim Remedial Action
IMP	Integrated Monitoring Plan
ISMS	Integrated Safety Management System
IWCP	Integrated Work Control Program
kg	kilogram
K-H	Kaiser-Hill Company, L.L.C.
LDR	Land Disposal Restriction
LHSU	lower hydrostratigraphic unit
LRA	Lead Regulatory Agency

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ACRONYMS AND ABBREVIATIONS

MDL	method detection limit
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MOU	Memorandum of Understanding
NAAQS	National Ambient Air Quality Standard
nCi/g	nanocuries per gram
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NESHAP	National Emission Standard for Hazardous Air Pollutants
NFAA	No Further Accelerated Action
NOI	Notification of Intent
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
O+M	operation and maintenance
OLF	Original Landfill
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PAC	Potential Area of Concern
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene (or perchloroethene)
pCi/L	picocuries per liter
PCOC	potential contaminant of concern
PMJM	Preble's meadow jumping mouse
POC	Point of Compliance
PPE	personal protective equipment

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ACRONYMS AND ABBREVIATIONS

psf	pounds per square foot
Pu	plutonium
QA	quality assurance
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RFCA	Rocky Flats Cleanup Agreement
RFETS or Site	Rocky Flats Environmental Technology Site
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RL	reporting limit
SID	South Interceptor Ditch
Sr	strontium
SVOC	semivolatile organic compound
SWD	Soil Water Database
SWWB	Site-Wide Water Balance
TCE	trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TSP	total suspended particulates
U	uranium
USFWS	U.S. Fish and Wildlife Service
USHU	upper hydrostratigraphic unit
VOC	volatile organic compound
WQP	water quality parameter
WRW	wildlife refuge worker
WY	Water Year

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EXECUTIVE SUMMARY

This Interim Measure/Interim Remedial Action (IM/IRA) Decision Document presents the proposed accelerated action to remediate Individual Hazardous Substance Site (IHSS) Group SW-2 at the Rocky Flats Environmental Technology Site (RFETS or Site). IHSS Group SW-2 consists of two IHSSs: IHSS 115, the Original Landfill (OLF), and IHSS 196, the Filter Backwash Pond.

The OLF is a 20-acre area where construction debris and general facility wastes were placed from 1950 to 1968. The OLF is located on a south-facing slope just south of the Industrial Area (IA) pediment and borders the northern side of Woman Creek.

This IM/IRA summarizes the environmental data for IHSS Group SW-2, compares the data to Rocky Flats Cleanup Agreement (RFCA) action levels (ALs), presents and evaluates accelerated action alternatives, and describes the proposed action. Recent geotechnical data and groundwater modeling at the OLF are also summarized in the IM/IRA.

A review of the environmental data (see Section 4 of this IM/IRA) concludes the following:

- **Surface Soils (see Section 4.3)**: Metals, radionuclides, and organic compounds have been detected above background levels in surface soil; however, only uranium and a few polynuclear aromatic hydrocarbons (PAHs) are present in surface soil above the RFCA ALs. Uranium contamination is present in surface soil above the ALs at four sample locations. PAHs are ubiquitous in surface soil at the OLF; however, only two sample locations have PAH concentrations that exceed the ALs,

- **Subsurface Soils (see Section 4.4)**: Metals, radionuclides, and organics have been detected above background levels in subsurface soil; however, only PAHs were detected above the ALs and only in an isolated location.

- **Groundwater (see Section 4.5)**: Metals, radionuclides, and organic compounds have been detected in groundwater at concentrations that are above background and the Tier II ALs. However, the number of detections above background and the Tier II ALs was generally very low for all of these constituents, and their concentrations were also generally very low relative to background and the Tier II ALs. Uranium-238 exceeds the Tier I AL in one well at the OLF. However, this exceedance is likely due to the surface soil uranium contamination, and the contamination has not migrated beyond this single well. Furthermore, chlorinated solvent contamination in groundwater does not extend downgradient of the OLF. The most recent volatile organic compound (VOC) data for these wells (last 3 years) indicate that chlorinated solvents are either not detected, or detected at trace concentrations below 1 µg/L. There is no plume of contaminated groundwater emanating from the OLF. Groundwater fate and transport modeling also indicates that the constituents in groundwater will not reach Woman Creek above surface water action levels. Therefore, groundwater quality is not significantly impacted by the OLF.

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- **Surface Water (see Section 4.6)**: Several metals, radionuclides, and organic compounds have been detected above background levels within Woman Creek surface water downgradient of the OLF. However, the concentrations of many of these analytes were only occasionally above the surface water ALs (approximately 5 percent or fewer of the observations), and were generally low in magnitude relative to the surface water ALs. Several metals and organics detected above background in surface water downgradient of the OLF have not been detected above background in upgradient surface water. However, these analyte concentrations typically were low relative to the surface water ALs, with only infrequent concentrations above the surface water ALs (fewer than 7 percent of any analyte sampled exceeded the AL). This frequency of occurrence is not sufficient to indicate that the OLF has had a significant impact on surface water quality.

- **Sediments (see Section 4.7)**: A few metals were detected above background in the sediment of Woman Creek and the South Interceptor Ditch (SID) in the vicinity of the OLF; however, concentrations were orders of magnitude below the RFCA ALs.

During the 1995 geotechnical study, historic areas of discrete landslides were identified in the area of the OLF before any waste was placed. However, there are no indications of landsliding at the OLF since waste disposal stopped in 1968. Erosion and sloughing of the hummocky surface due to historic waste placement and faulty stormwater management practices have exposed some waste at the surface of the OLF. Geotechnical testing (conducted in 2004) has provided data to further evaluate the structural stability of the OLF. These data have provided additional information on the strength of the underlying subsoil and weathered bedrock to be used in the design of the accelerated action.

Four accelerated action alternatives have been evaluated in the IM/IRA to address direct contact with the waste materials, control stormwater and erosion, and address the structural stability of the OLF. These four accelerated action alternatives include:

- No Action

- Removal of surface soil "hot spots" and site grading with a soil cover;

- Removal of surface soil "hot spots," and site grading with a soil cover and buttress fill at the toe of the OLF slope (this alternative also includes an evaluation of an upgradient groundwater "cutoff" wall); and

- Removal of surface soil "hot spots," and removal and off-site disposal of the wastes placed at the OLF.

A comparative evaluation has been conducted on these accelerated action alternatives using the criteria of effectiveness, implementability, structural stability, and relative cost. Site grading with a soil cover and buttress fill is the proposed accelerated action for the OLF for the following reasons:

- The surface soil areas with concentrations that exceeded the uranium ALs were removed in August 2004.

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- Regrading the site will eliminate the ponding of stormwater at the surface of the OLF and provide for positive runoff and run-on control of stormwater.

- Adding a soil cover will eliminate the exposure and direct contact of the waste materials at the surface of the OLF.

- Reducing the existing surface slopes (regrading) will eliminate surface soil sloughing and erosion, and provide a structurally stable area to contain the waste materials.

- Construction of the buttress at the toe of the slope, will increase the stability factors of safety.

- Implementing this proposed accelerated action would not permanently impact the habitat of the Preble's Meadows Jumping Mouse or impact Woman Creek.

- Implementing this proposed accelerated action is cost effective since the data and OLF evaluations indicate the OLF is not now a significant source of contamination to the environment

Actions undertaken to implement the approved accelerated action will be documented in a Closeout Report.

Post-accelerated action monitoring and maintenance are also described in the IM/IRA (see Appendix B) and include, groundwater monitoring, surface water monitoring, and monitoring of the structural stability of the graded slope.

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1.0 INTRODUCTION

This Interim Measure/Interim Remedial Action (IM/IRA) Decision Document presents the proposed accelerated action to remediate Individual Hazardous Substance Site (IHSS) Group SW-2 at the Rocky Flats Environmental Technology Site (RFETS or Site). IHSS Group SW-2 consists of two IHSSs: IHSS 115, the Original Landfill (OLF), and IHSS 196, the Filter Backwash Pond.

RFETS is a Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) National Priority List (NPL) site and is located in rural northern Jefferson County, Colorado, approximately 16 miles northwest of Denver. It is approximately 6,240 acres in area. The developed portion of the Site, referred to as the IA, is centrally located within RFETS and occupies approximately 600 acres. The Rocky Flats Buffer Zone (BZ) surrounds the IA and occupies the remaining 5,640 acres. IHSS Group SW-2 is located in the southern part of the IA Operable Unit (OU) and adjacent to the Buffer Zone OU. Figures 1-1 and 1-2 present the locations of the Site and IHSSs 115 and 196, respectively.

The Rocky Flats Cleanup Agreement (RFCA) (DOE et al. 1996) is a CERCLA federal facility cleanup agreement as well as a compliance order on consent under the Resource Conservation and Recovery Act (RCRA) and the Colorado Hazardous Waste Act (CHWA) between the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency, Region VIII (EPA), and the Colorado Department of Public Health and Environment (CDPHE). RFCA provides the regulatory framework for cleanup of hazardous substances at the Site. In accordance with RFCA, this IM/IRA is subject to CDPHE, EPA, and public review and comment, and also approval by CDPHE, the Lead Regulatory Agency for RFCA accelerated actions in the IA OU.

This IM/IRA presents the environmental data for IHSS Group SW-2, compares the data to RFCA action levels (ALs), presents and evaluates accelerated action alternatives, and describes the proposed actions. Actions undertaken to implement the approved accelerated action will be documented in a Closeout Report.

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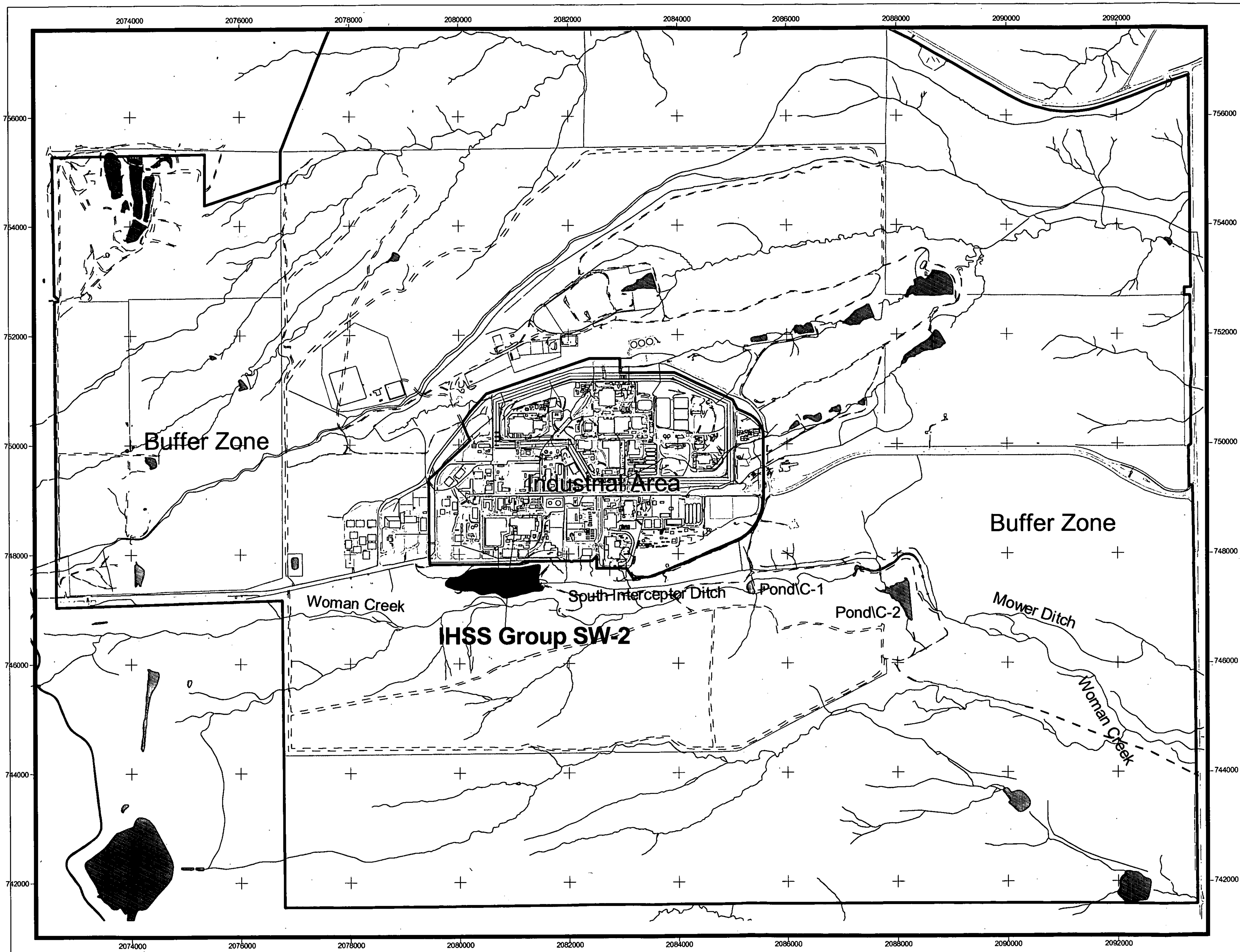

Figure 1-1
IHSS Group SW-2
Location Map

KEY

- IHSS Group SW-2
- Building
- Stream, ditch, or drainage
- Paved area
- Dirt road
- Fence

N

800 0 800 1600 Feet

Scale = 1:20,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:

RADMS

Prepared for:

KAISER•HILL
COMPANY

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November 2002

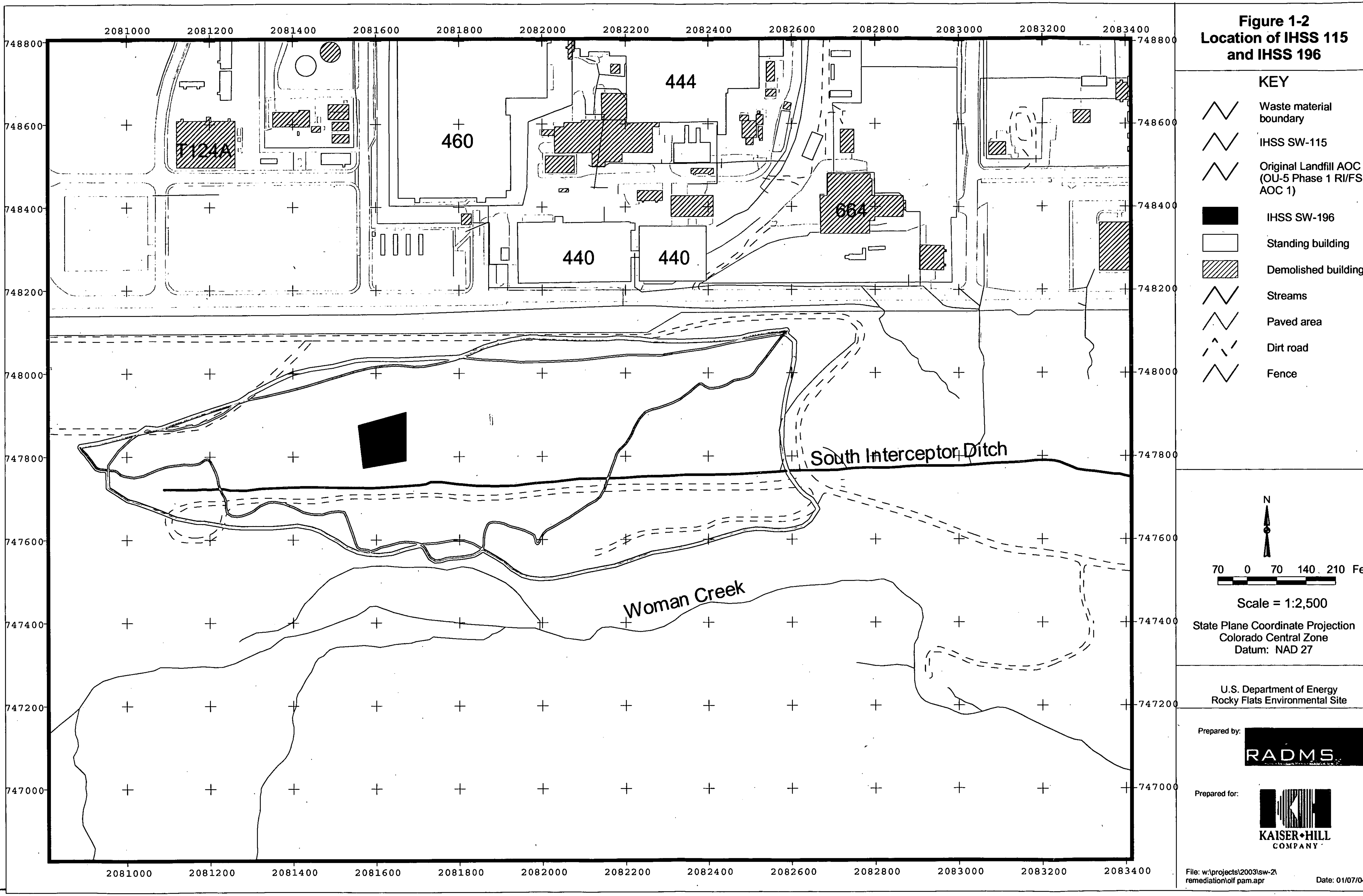

Figure 1-2
Location of IHSS 115 and IHSS 196

1.1 Need for RFCA Accelerated Action

Between 1952 and 1968, approximately 74,000 cubic yards of solid waste consisting of construction and other debris and general plant waste contaminated with or commingled with small amounts of wastes with hazardous constituents were disposed in the approximately 20-acre OLF, IHSS-115. The OLF is located on the southern-facing slope just south of the IA pediment and borders the northern side of Woman Creek. Because of the slope angle and underlying bedrock characteristics, this area has been identified as susceptible to landslides and erosion.

From the early 1950s until 1971, filter backwash wastewater generated by the raw water treatment process in Building 124 to make potable water was discharged to settling and evaporation ponds located roughly in the center of IHSS 115, designated the Filter Backwash Pond, IHSS 196. A soil cover was placed over the disposed waste when the OLF was closed in 1968. Some of the wastes and debris have become exposed through erosion of the soil cover over the wastes that were placed at steep slopes. Besides the soil cover, soil fill material was used in the waste disposal operation. The volume of disposed waste and commingled soil is estimated at 160,000 cubic yards.

IHSSs 115 and 196 were formerly part of OU 5, the Woman Creek Priority Drainage, which was consolidated into the IA OU when RFCA became effective in July 1996. Prior to this consolidation, a Phase 1 RCRA Facility Investigation/Remedial Investigation (RFI/RI) for OU-5 was conducted pursuant to an RFI/RI Work Plan, which was approved by CDPHE and EPA in 1992 (EPA 1992a, 1992b; CDPHE 1992). For purposes of the investigation work the OU-5 IHSSs (and Potential Areas of Concern [PACs]) were separated into specific Areas of Concern (AOCs). The IHSSs 115 and 196 were designated AOC 1.

One of the purposes of the OU-5 Phase 1 RFI/RI for the OLF was to gather sufficient geotechnical information to evaluate landslide mechanisms in the OLF. The OU-5 Phase 1 RFI/RI also included source and environmental media characterization for the OLF and a human health and ecological risk assessment for Area 1. The OU-5 Phase 1 RFI/RI Report was completed in 1996 (Kaiser-Hill 1996).

Section 2.0, Site Background, Section 3.0, Environmental Setting, and Section 4.0, Environmental Data Summary and RFCA Action Level Comparison of this IM/IRA, provide detailed information about the OLF and Filter Backwash Pond history and the OU-5 Phase 1 RFI/RI.

In addition to the problems posed by inadequate soil cover, which allows possible direct contact with the disposed wastes, sampling and analysis of soil, surface water, and groundwater have shown some contamination above background levels. Some organic compounds and metals (including depleted uranium) contamination is present at levels greater than action levels and/or standards applicable to these media contained in the *Action Levels and Standards Framework for Surface Water, Ground Water and Soils* (ALF), RFCA Attachment 5. Pursuant to RFCA, if ALF action levels or standards are exceeded, an evaluation, remedial action, and/or management action is triggered.

DOE proposes to conduct a remedial action for the OLF and Filter Backwash Pond. Pursuant to RFCA, remedial actions taken for one or more IHSSs will be conducted as a RFCA accelerated action. Because this accelerated action is estimated to take longer than six months from the time of commencement of physical work to complete, RFCA requires that the work will be conducted pursuant to an IM/IRA. Section 10.0, Implementation Schedule of this IM/IRA, provides an informational schedule for the major work activities, which are expected to take just over 6 months to complete.

1.2 Proposed Accelerated Action – The Municipal Landfill Presumptive Remedy

EPA has published two directives regarding the application of the "source containment" presumptive remedy to municipal and military landfills (EPA 1993a, 1996).

> *"Presumptive remedies are preferred technologies for common categories of sites based on historical patterns of remedy selection and EPA's scientific and engineering evaluation of performance data on technology implementation. By streamlining site investigation and accelerating the remedy selection process, presumptive remedies are expected to ensure consistent selection of remedial actions to reduce the cost and time required to clean up similar sites. Presumptive remedies are expected to be used at all appropriate sites. Site-specific circumstances dictate whether a presumptive remedy is appropriate at a given site."*

Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills, OSWER Directive No. 9355.0-67FS, December 1996, p.1. The directive recognizes that military landfills may contain waste types that are different from those found in municipal landfills but that pose a hazard profile similar to that of municipal landfills. The directive provides criteria for evaluating whether the landfill contents have characteristics similar to municipal landfill contents. If the characteristics are similar, then the presumptive remedy should be considered and implemented if appropriate. Although, the OLF is not on a military base, because of its size and waste types, it is similar to military landfills at other NPL Sites where the presumptive remedy has been implemented.

EPA has also published several directives regarding conducting and streamlining Remedial Investigations/Feasibility Studies at CERCLA municipal landfill sites (EPA 1991a; 1994). The presumptive remedy process involves using existing data to the extent possible and limiting the characterization of the landfill contents, conducting a streamlined risk assessment, and developing a focused feasibility study to analyze only those alternatives consisting of appropriate components of the presumptive remedy.

The OU-5 Phase 1 RFI/RI Report and groundwater and surface water monitoring provide sufficient information to evaluate the OLF in accordance with the military and municipal landfill presumptive remedy guidance. Section 5.0, Remedial Objectives of this IM/IRA, provides a discussion of whether the "source containment" remedy is appropriate. Section 6.0, Remedial Action Alternatives Evaluation, and Section 7.0, Proposed Remedial

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Action Plan, provide details regarding the components of the proposed source containment remedy. Section 6.0 also evaluates the "no action" and removal alternatives.

Section 7 presents the proposed accelerated action plan. Section 8.0, Applicable or Relevant and Appropriate Requirements (ARARs), along with Appendix A, provides a discussion of the regulations pertaining to this accelerated action. Section 9.0, Environmental Impacts, presents an analysis of the environmental consequences associated with the proposed action. Section 10.0 and 11.0 discuss the implementation schedule and closeout report, respectively. Section 12.0, Administrative Record, identifies the documents considered by DOE, CDPHE, and EPA in proposing this accelerated action, which are available for public review at the Rocky Flats Reading Room.

2.0 SITE BACKGROUND

2.1 IHSS Group SW-2 Site Description

IHSS Group SW-2 covers approximately 20 acres and includes two IHSSs: IHSS 115, the OLF, and IHSS 196, the Filter Backwash Pond. IHSS 115 is located south of the RFETS IA pediment on a south-facing hill slope north of Woman Creek. IHSS 196 lies approximately in the center of IHSS 115. Approximately 1,000 ft of the South Interceptor Ditch (SID), and storm drain and building footer drain discharge pipes and other disturbed areas lie within IHSS 115. (See Figure 2-1) These IHSSs were formerly part of OU 5, Woman Creek Priority Drainage. An OU 5 Phase I RFI/RI was conducted in accordance with an approved work plan; a draft final report was issued in April 1996 (Kaiser-Hill 1996).

2.2 Description and History of IHSS 115 (OLF)

The OLF was used to dispose of solid sanitary and construction debris wastes generated at the Rocky Flats Plant from 1952 to 1968 (Rockwell 1988). The landfill was not designed or operated as an engineered landfill. Aerial photographs indicate that the landfill was operated as an area fill (EG&G 1994). Waste was merely dumped in the area vertically below and just south of the southern edge of the alluvial pediment on which the RFETS IA is located. The waste disposal area lies north of Woman Creek. The waste was generally spread over the south-facing hillside, serving to fill in the area below the pediment edge. No liner or other collection barrier was installed between the waste and the existing surfaces.

In the waste placement process, the waste material was mixed with soil materials. The volume of disposed waste and commingled soil is estimated at 160,000 cubic yards. Because of the slope angle, and the geological mapping and characterization of the colluvial and weathered bedrock material making up the hillside, the hillside in this area has been identified as susceptible to sliding even before the slope was covered with waste fill (Metcalf & Eddy 1995).

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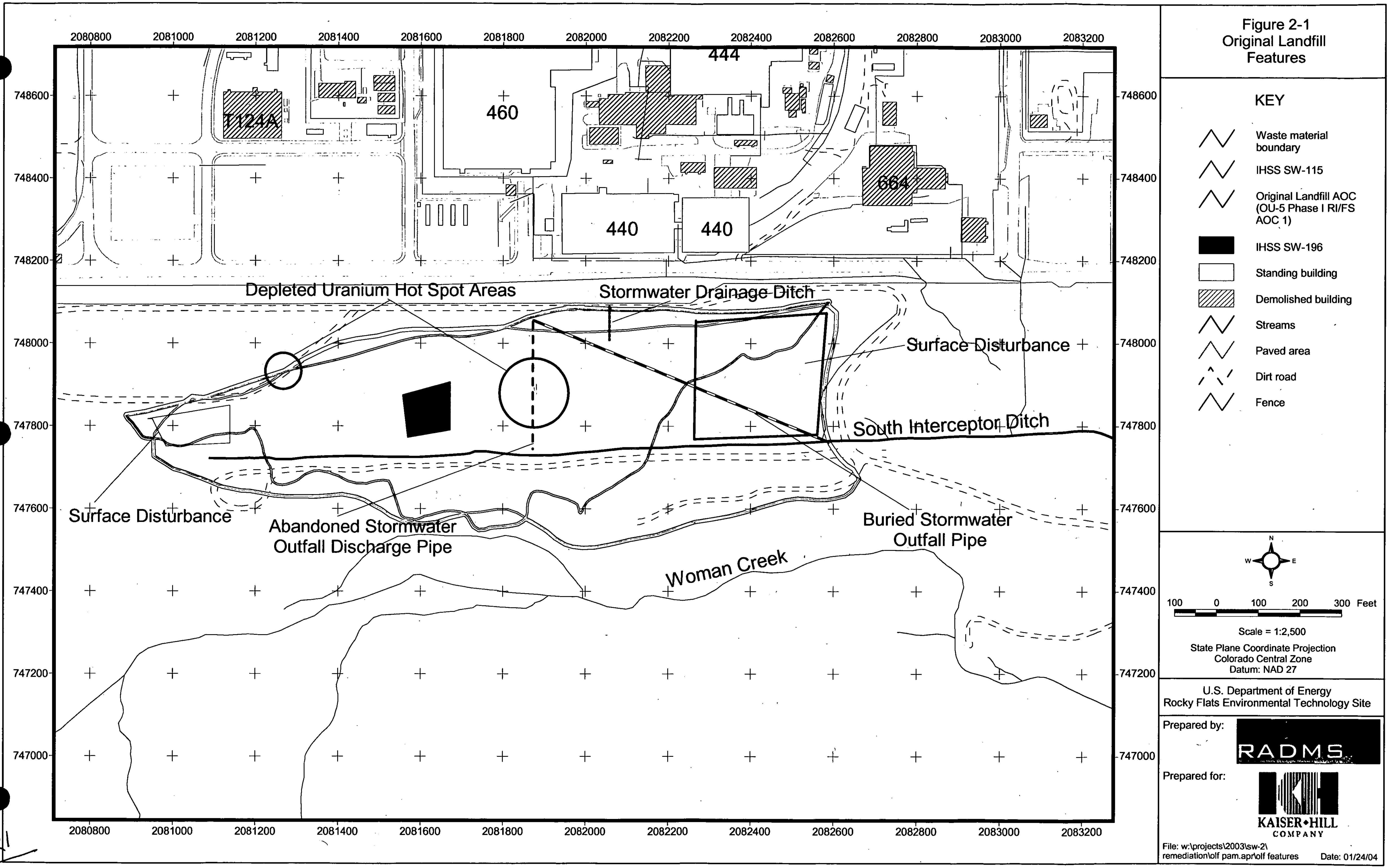
Figure 2-1
Original Landfill
Features
KEY
Waste material boundary
IHSS SW-115
Original Landfill AOC (OU-5 Phase I RI/FS AOC 1)
IHSS SW-196
Standing building
Demolished building
Streams
Paved area
Dirt road
Fence
T124A
460
444
440
440
664
Depleted Uranium Hot Spot Areas
Stormwater Drainage Ditch
Surface Disturbance
South Interceptor Ditch
Surface Disturbance
Abandoned Stormwater
Outfall Discharge Pipe
Buried Stormwater
Outfall Pipe
Woman Creek
2080800
2081000
2081200
2081400
2081600
2081800
2082000
2082200
2082400
2082600
2082800
2083000
2083200
748600
748400
748200
748000
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747400
747200
747000
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100
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Feet
Scale = 1:2,500
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27
U.S. Department of Energy
Rocky Flats Environmental Technology Site
Prepared by:
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COMPANY
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Date: 01/24/04

Disposal operations at the OLF ceased by the fall of 1968 possibly due to the Present Landfill (IHSS 114, located north of the IA) which began operation on August 17, 1968 (EG&G 1992a). The OLF waste material was covered with a soil layer after disposal operations ceased (EG&G 1994). Details on the placement of the soil cover layer, including exactly when it was constructed, are not available. Portions of the slope on the southern side of the landfill were later regraded to correct sloughing and erosion problems. Accurate and verifiable records of the wastes placed in the landfill are not available. However, approximately 74,000 cubic yards of sanitary waste and construction debris were disposed in the landfill (Kaiser-Hill 1996). These types of wastes likely included relatively small quantities of organics, paint and paint thinner, oil, pesticides, and cleaners (Rockwell 1988). Commonly used organics from 1952 to 1968 may have included trichloroethene, carbon tetrachloride, tetrachloroethene, petroleum distillates, 1,1,1-trichloroethane, dichloromethane, and benzene (Kaiser-Hill 1996). In the 1960s, the landfill may have received polychlorinated biphenyls (PCB) wastes (DOE 1992), such as carbonless copy paper, transformer and vacuum pump cleanup paper and rags, and small capacitors and fluorescent light bulbs. Metals such as beryllium, lead, and chromium, may also have been placed in the landfill (Rockwell 1988).

There is no information indicating that the OLF was used for routine disposal of radioactive material or other hazardous substance waste streams. During the period of operation of the OLF, several other areas within RFETS were used for the management and disposal of hazardous plant wastes, including radioactive waste. For example, some uranium wastes were buried in the east trenches, and drums with cutting oils and solvents were stored at the 903 Pad. These areas are described in the Historical Release Report (HRR) (EG&G 1992a) and subsequent annual updates. The majority of radioactive solid waste generated on site was disposed off site. Various controls and practices were used to segregate and manage radioactive wastes separately from plant sanitary waste and construction debris. Although the OLF was not operated for management or disposal of radioactive waste, information in the HRR and characterization results indicate that some waste contaminated with radioactive material, most notably wastes from buildings where depleted uranium (DU) operations were conducted, were disposed in the OLF. In addition, in 1965, 60 kilograms (kg) of DU were placed in the landfill after the DU, which was left on a pallet, reportedly ignited on a truck flatbed. The DU was probably covered with soil to extinguish the fire. Efforts were later made to retrieve the DU, however, only 40 kg were recovered. Further use of the affected area of the landfill was avoided (EG&G 1992a; DOE 1992). No record of any similar incident was found and workers have reported none. Further removal of DU in contaminated surface soil was completed in August 2004 leaving all surface soils below the ALs.

Activities listed for the OLF in October 1954 include its use as a burning pit for the plant (EG&G 1992a). Ash from the plant incinerator, graphite, used caustic drums, and general trash may have been dumped in the burn pit; however, no records of waste types have been found. Incinerator ash, for at least the first decade of plant operation, included ash derived from the incineration of combustible paper and other trash contaminated with low levels of DU surface contamination from Building 444, in addition to other combustible plant wastes (EG&G 1992a). Although some incinerator ash may have been disposed of in the OLF, the ash was routinely disposed of in several pits west of the OLF,

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namely, IHSS-133, the Incinerator Ash Pits. Based on investigation and characterization of the Incinerator Ash Pits, a RFCA No Further Accelerated Action (NFAA) determination was approved. (EPA 2003) Backwash water discharged from the water treatment plant passed through a drainage channel on the western side of the burn pit, and flowed down to Woman Creek. No information is available identifying the period of operation for the burn pit.

In 1995, Metcalf and Eddy conducted geotechnical investigations at the OLF as part of the OU-5 Phase 1 RFI/RI and described the fill material encountered during the investigation. The material consisted of waste mixed with varying amounts of sandy, clayey gravel and cobbles derived from colluvium and Rocky Flats Alluvium. The waste materials in the fill included sheet metal, wood, broken glass, plastic, rubber, metal shavings, graphite sand, solid blocks of graphite, concrete, asphalt, and portions of 55-gallon steel drums. The waste fill ranged in thickness from 2 ft to over 11 ft.

Seepage emerging from the OLF after a major rainstorm in July 1986 was traced to an outfall pipe from the Building 460 footing drains (EG&G 1992a). Sloughing of material in the area of the outfall occurred as a result and the hillside materials may have been washed into the South Interceptor Ditch (SID). To prevent migration of materials, a containment embankment was constructed to prevent flow into Woman Creek (EG&G 1992). The outfall piping was also extended to the east to discharge beyond the landfill boundary (refer to Section 2.4).

Street cleaning wastes were apparently dumped in the OLF area. The duration of use of this area for street cleaning wastes is not known. In March 1991, EPA requested that the dumping cease because it may exacerbate any groundwater and soil contamination and it was inconsistent with the planned CERCLA response (EPA 1991b). In July 1991, the contractor notified DOE that it had instructed the appropriate departments not to use the landfill as a dumping site for street sweeping litter or concrete truck washout (EG&G 1991).

2.3 Description and History of IHSS 196 (Filter Backwash Pond)

The water treatment plant Filter Backwash Pond was located on the hillside north of Woman Creek, approximately 800 ft south of the water supply treatment plant in Building 124 (EG&G 1992). The treatment plant treats water that is delivered from the Denver Water Board reservoir and ditch system to the raw water pond located north of the West Access Road to produce the plant's potable water. The Filter Backwash Pond, also known as Pond 6, was used as a retention pond to allow sampling of filter backwash water. It was also described as an evaporation and settling pond (EG&G 1992b). There is no record of sludge or sediment removal from the pond (DOE 1992b).

Pond 6 was constructed in 1955. However, water from the water treatment plant was discharged at the OLF before the pond was constructed. The HRR (EG&G 1992a) refers to an October 1954 reference that indicates backwash water from the water treatment plant flowed through the western side of the burning pit and down to Woman Creek. It is possible that Pond 6 was constructed in the location of the burning pit (EG&G 1992a). It

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is unclear when the Filter Backwash Pond was abandoned. By 1964, Pond 6 was no longer present, and the area was covered with fill (Kaiser-Hill 1996).

The effluent from the water treatment plant was discontinuous and probably made up of filter backwash, filter pre-wash, sludge blowdown, and other discharges from the water treatment process (EG&G 1992). It contained filterable solids removed from the raw water, as well as chemical flocculants (aluminum sulfate or lime) and residual chlorine (EG&G 1992).

2.4 Other Disturbances and Structures

Other disturbances and structures associated with IHSS Group SW-2 include a large surface disturbance located east of the landfill area, the SID, and two outfall pipes and their associated surface disturbances. An area of suspected surface disturbance and a possible pit were identified west of the landfill from a review of aerial photographs (EG&G 1994) (See Figure 2-1).

The surface disturbance area east of the landfill waste disposal area was also identified from review of aerial photographs for the OLF site (EG&G 1994). The area was active in the 1964 photography. Little historical information is available for this area; however, the area may have served as a storage yard for pipes and scrap metal (EG&G 1994). In the 1969 and 1971 aerial photographs, the area contains mounds of debris (EG&G 1994).

In 1980, the SID was built across the southern portion of the landfill (EG&G 1994). The purpose of the SID was to intercept runoff from the southern portions of the Rocky Flats Plant and divert the flow to Pond C-2. Two outfall pipes cross the OLF site. The original outfall pipe, constructed in 1986 (EG&G 1994), discharged storm water directly onto the landfill. This caused sloughing and sliding of the fill material. Slide material may have been removed from the SID and placed on the southern side of the gravel road constructed south of the SID (Metcalf & Eddy 1995). Sometime between 1986 and 1988, the original outfall pipe was abandoned and a new outfall pipe was constructed southeast across the OLF to discharge to the SID east of the landfill boundary. The buried outfall pipe discharges into a collection basin located east of the OLF. Sloughing, erosion, and construction of the outfall pipes may have exposed landfill waste at the surface.

2.5 Historical Interim Response Actions

Three separate response actions have been undertaken at the OLF. On July 23, 1979, contractors grading a road southwest of Building 444 outside the perimeter fence uncovered a portion of the landfill (EG&G 1992). The area was surveyed and three locations of depleted uranium were identified. One box of contaminated soil was removed (EG&G 1992).

The reach of Woman Creek adjacent to the western portion of the landfill was relocated because the creek threatened to erode into landfill materials (Singer 2002). Specific information on the relocation of Woman Creek, including when the creek was relocated, is not available.

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On June 7, 1990, EPA, CDPHE, and DOE staff conducted an inspection to evaluate previously identified exposed radioactive debris in the northwestern part of the OLF (EPA 1990). It is not known exactly when the debris became exposed; however, the area apparently was identified in April 1990 as a barrel containing radioactive materials (DOE 1990). A radioactive materials survey near the barrel encountered low levels of depleted uranium (EG&G 1990a). The area was roped off and access was restricted. Soil and water samples were collected and a requested radiological survey of the entire OLF area was subsequently conducted (EG&G 1990b). A gamma radiation survey conducted in late 1990 identified ten locations of elevated gamma radiation (Kaiser-Hill 1996).

A radiological survey with a Field Instrument for the Detection of Low-Energy Radiation (FIDLER) was also conducted at the OLF in 1993 as part of the OU-5 Phase 1 RFI/RI (EG&G 1994). Of the ten areas identified in 1990, the FIDLER survey did not identify any anomalous levels of radiation at seven of the locations. Within the bounds of two areas in the center of the OLF identified by the 1990 survey, nine areas of anomalous levels of radiation were found. These areas were posted as Radiologically Controlled Areas. Several pieces of radioactive material were removed from these areas on May 28, 1993, during an emergency removal action. The material removed included a 4- to 6-inch-diameter piece of concrete coated with a corroded metallic material, and several small (1- to 2-inch-diameter) spherical pieces of rusty material. The materials were removed for subsequent management as radioactive material (EG&G 1994). Analyses indicated that the materials contained depleted uranium. In those areas where a specific source of the anomalous radioactivity could not be identified, surface soil samples were collected.

In July 2004, surface soil contaminated with uranium above Wildlife Refuge Worker Action Levels was removed (see Appendix E).

Annual walkdowns of the landfill surface have been conducted each spring to search for classified items since 2000. No classified items have been found; however, several carbon molds have been removed from the area and appropriately dispositioned. Some of the items have exhibited very low levels of depleted uranium activity.

2.6 Slope Stability

Landslides have historically occurred at the OLF site within the colluvium and weathered bedrock prior to waste placement. During the 1995 geotechnical study, these historic areas of discrete landslides were identified in the OLF, as well as general areas of sliding (Kaiser-Hill 1996). In addition, the geotechnical study identified three potential slope failure mechanisms operating in the OLF area. These mechanisms are:

- Shallow landslides consisting of waste fill sliding on severely weathered claystone;
- Shallow landslides consisting of colluvium sliding on or with severely weathered claystone; and

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- Deeper landslides consisting of movement within moderately weathered claystone at depths up to or approximately 35 ft, especially in areas of steeper slopes.

Landslides on the claystone bedrock slopes beneath the alluvial surface probably commenced after the slopes were initially exposed by continued stream erosion through the pediment, rendering the overlying materials unstable and predisposing them toward movement. Aerial photographs of the Woman Creek drainage prior to the waste disposal support this theory by indicating that most landslides occurred prior to fill deposition. There is no indication of current landsliding or mass movement of the waste and soil fill. Additional geotechnical data have been gathered to further evaluate the stability of the OLF (see Section 3.4).

2.7 Existing Conditions

It has been approximately 36 years since disposal operations ceased at the OLF. The area now has well-established grasses and forbs, several stands of large trees, and several small areas of wetland vegetation. Most of the waste is currently covered by soil up to several feet thick; however, the surface of the area is hummocky, and some disposed materials are protruding from the ground in some areas. This indicates uneven waste and cover soil layer placement resulting in erosion and sloughing processes that uncover the wastes. The thickness and final grading and cover soil layer appears to be inadequate in a few places. There is no indication of current landsliding or mass movement of the waste and soil fill. There are no seeps in the area. Stormwater ponding occurs in several areas because of the surface topography. Several radionuclide contamination "hot spots" have been identified via surface soil sampling (refer to Section 4.3) and were removed in August 2004 (see Appendix E).

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3.0 ENVIRONMENTAL SETTING

3.1 Physiography

RFETS is located on the western margin of the Colorado Piedmont section of the Great Plains Physiographic Province at an elevation of approximately 6,000 ft (Kaiser-Hill 1996). The Colorado Piedmont is characterized as an area of dissected and denuded topography, representing an old erosion surface along the eastern margin of the Rocky Mountains. Several pediments (broad sloping planes formed by coalescing alluvial fans along a mountain front) developed across bedrock in the RFETS area during the Quaternary Period (Scott 1963). The Rocky Flats pediment is the most extensive of these pediments.

The RFETS IA is located on a relatively flat surface of the Rocky Flats pediment. The pediment surface has been eroded by Walnut Creek on the north and Woman Creek on the south. As a result, the pediment surface is located at an elevation of 50 to 150 ft above the creeks. The grade of the gently eastward-sloping surface of the Rocky Flats pediment ranges from one percent in the IA of RFETS to approximately two percent just east of the IA. Further east, the pediment's nearly flat-lying surface gives way to lower, gently rolling terrain of the High Plains section of the Great Plains Physiographic Province (Kaiser-Hill 1996).

Four ephemeral creeks drain the surface water from RFETS. Surface water that flows from the northern portion of RFETS is drained by Rock Creek, which is a northeast-trending tributary of Coal Creek. The central and southern portions of the site are drained by Walnut Creek, South Walnut Creek, and Woman Creek. These drainages are all tributaries of Big Dry Creek that flows eastward. Coal Creek separates all of the streams on the Rocky Flats pediment from the Front Range foothills. Surface water flow in these creeks is generally ephemeral; however, some reaches may support intermittent or perennial flow.

3.2 Climate

The climate at RFETS is characterized as semiarid (Kaiser-Hill 1996) with a mean annual precipitation of approximately 15.5 inches, based on 20-year means for Boulder and Lakewood, Colorado. The wettest season is spring (March through May), which accounts for approximately 40 percent of the annual precipitation, much of which is snow. Thunderstorms during the summer months provide another 30 percent of the annual precipitation. The precipitation gradually declines through the summer, fall, and winter (Kaiser-Hill 1996). Average annual pan evaporation in central Colorado is approximately 55 inches (DBS 2001).

The predominant wind direction at RFETS is northwesterly, and average wind speeds are under 15 miles per hour. Daytime heating causes upslope winds to form, with northeasterly winds common over the broad South Platte River Valley. More localized southeasterly winds also occasionally occur during the day at the Site because the terrain is oriented southeast toward Standley Lake and the city of Arvada. The winds reverse at

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night with a shallow, westerly drainage wind forming over the Site and a broad, southerly drainage wind forming over the South Platte River Valley (DOE 1999).

RFETS is noted for its strong winds. Gusty winds frequently occur with thunderstorms and the passage of weather fronts. The highest wind speeds occur during the winter as westerly windstorms, known as chinooks. The windstorm season at the Site extends from late November into April, with the height of the season usually occurring in January. The windstorms typically last 8 to 16 hours, with wind speeds exceeding 75 miles per hour in almost every season. Wind gusts exceeding 100 miles per hour are experienced every three to four years (DOE 1999).

3.3 Geology

Geologic units beneath the OLF consist of unconsolidated Quaternary deposits that lie unconformably over Cretaceous claystone bedrock. Six north-south cross sections were developed during the 1995 geotechnical study. One cross section, Figure 3-1, is typical of the other cross sections developed in the study. (EG&G, 1995; Kaiser-Hill, 1996) The unconsolidated surface deposits include the Rocky Flats Alluvium that dominates the surface of RFETS, colluvial materials that form the slopes of the Woman Creek valley, and valley fill materials on the bottom of the Woman Creek valley. These materials overlie the Laramie Formation bedrock (Metcalf & Eddy 1995). Geologic units in the OLF area are described below.

3.3.1 Rocky Flats Alluvium

The Rocky Flats Alluvium was deposited by a system of coalescing alluvial fans aggraded by debris flows and braided streams along the base of the Front Range at the mouth of Coal Creek Canyon (EG&G 1995). The alluvial deposits generally consist of beds and lenses of poorly sorted, clast- and matrix-supported, white-to-pink, sandy, cobbly gravel, gravelly sand, and silty sand (Kaiser-Hill 1996). The thickness of this unit ranges from about 3 to 30 ft in the areas where the pediment deposits overlie Cretaceous-aged bedrock (Kaiser-Hill 1996).

3.3.2 Colluvial Deposits

Colluvial deposits along the valley slopes at RFETS are middle Pleistocene to recent in age (Kaiser-Hill 1996). The colluvial material commonly consists of dark-gray to light, reddish-brown, silty sand, sandy silt, clayey silt, and silty clay that contains minor amounts of boulders and cobbles. The unit locally includes clast- and matrix-supported boulders and cobbles, and coarse to fine gravel in a silty-clay matrix. These materials are well graded to poorly graded and unstratified to poorly stratified. Clasts are typically subangular to subrounded, and their sedimentological composition reflects that of the bedrock and surface deposits from which they were derived. The thickness of the colluvial deposits ranges from 3 to 15 ft.

In the OLF area, the unconsolidated colluvial deposits consist of sandy, clayey gravel (derived from the adjacent Rocky Flats Alluvium) to sandy clay (Metcalf & Eddy 1995). The colluvium is frequently mixed with fill material in the landfill. Soil borings indicate

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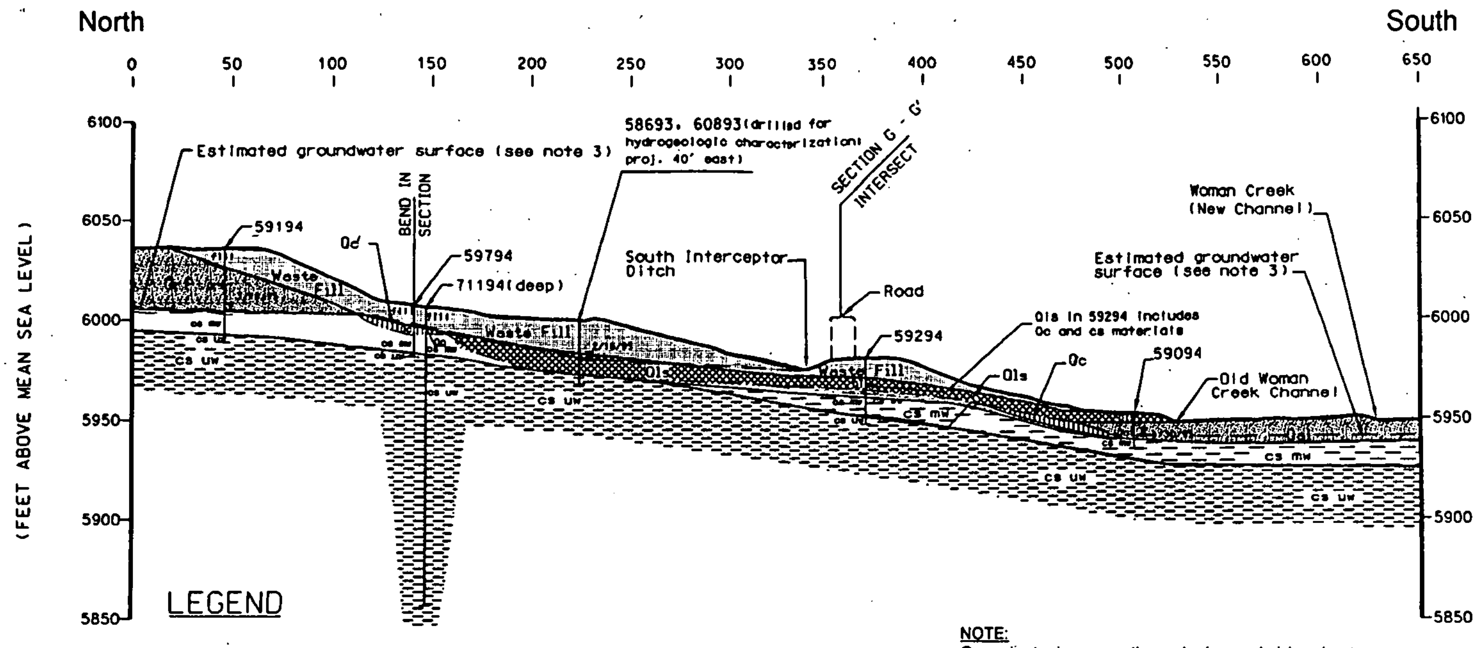
the thickness of the colluvium ranges from 1 to 13 ft. The colluvium is damp to moist, although it can be wet near its contact with the Laramie Formation (Metcalf & Eddy 1995).

3.3.3 Valley-fill Alluvium

Valley-fill alluvium, located along the Woman Creek drainage, includes channel and terrace deposits related to the modern stream. These recent alluvial deposits are commonly grayish-brown, slightly cobbly, silty sand to sandy, clayey silt in the upper part, and poorly sorted, clast-supported, slightly cobbly, gravel in a light yellowish brown, clayey, silty sand matrix in the lower part (Kaiser-Hill 1996). Clasts are mostly subangular quartzite, with a minor amount of subrounded sandstone derived from older Quaternary deposits. The thickness of these deposits ranges from approximately 3 to 15 ft, with an average of about 10 ft.

During geotechnical investigations at the OLF (Metcalf & Eddy 1995), valley fill alluvium was encountered in three boreholes along the toe of the landfill. The alluvium consisted of medium dense-to-dense, sandy, silty, clayey gravel with cobbles. The alluvium ranged from 5 to 7 ft thick, and groundwater was encountered as shallow as two feet below ground surface (bgs).

Figure 3-1 Typical Geological Cross Section of the Original Landfill



LEGEND

- Waste fill
- Qc — Colluvium
- Qls — Landslide Deposits (unit may contain material from several discrete landslides).
- Valley Fill Alluvium
- Rocky Flats Alluvium
- cs — Laramie Formation Claystone:
  - sw — severely weathered
  - mw — moderately weathered
  - uw — unweathered

SCALE IN FEET (50 0 50)

59194 — Geotechnical boring, backfilled or with monitoring well, showing geologic units, groundwater elevation and date measured.

DRAFT

Source: Metcalf & Eddy 1995

3.3.4 Laramie Formation

Bedrock in the OLF area is Laramie Formation (Kaiser-Hill 1996). The Cretaceous-aged Laramie Formation is approximately 600 to 800 ft thick. It has been informally divided into upper and lower members (Kaiser-Hill 1996). The upper Laramie Formation is dominantly composed of fine-grained sedimentary rocks (primarily claystone with no thick sandstone beds). The upper part of the upper Laramie Formation is approximately 300 to 500 ft thick, and consists primarily of olive-gray to yellowish-orange claystone with large ironstone nodules. A few thin, discontinuous coal seams occur in the upper Laramie Formation. Lenticular beds of platey laminated or friable, calcareous, fine-grained, light olive-gray sandstone occur in the upper Laramie Formation, particularly in the upper portions of the formation.

In the OLF area, the Laramie Formation is a weak claystone formation that underlies the soil-bearing slopes in the OLF (Metcalf & Eddy 1995). It is severely weathered (soft, plastic, and moist) in its near-surface aspect and underlies surficial materials in over 50 percent of borings. Moderately weathered Laramie Formation underlies the severely weathered Laramie Formation and is locally plastic, soft, damp, and fractured. It was encountered underlying surficial material in approximately 35 percent of the borings, indicating that the severely eroded Laramie Formation was sometimes displaced through sliding or erosion. The unweathered Laramie formation is the deepest component of the upper member and is similar to the moderately weathered Laramie Formation, although somewhat drier (Metcalf & Eddy 1995).

3.3.5 Inferred Faulting

Several inferred faults had been identified during site-wide geological investigations at RFETS (EG&G 1995). The longest of these is a northeast-trending reverse fault that extends from Woman Creek to Colorado Highway 128 across the western part of the IA. The fault plane is assumed to dip to the west. A borehole drilled into this fault, or fault zone, in another portion of RFETS filled with water within a few hours of drilling (EG&G 1995). The Geological Characterization Report (EG&G 1995, Figure 7-6) shows the fault trace going through the western side of the OLF.

The geotechnical investigation of the OLF (Metcalf & Eddy 1995) considered the presence of this fault. Metcalf & Eddy (1995) identified the bedrock fault as trending southwest from the vicinity of Building 371 through the OLF between borings 59794/71194 and 57194. The general location of the fault is shown on Figure 3-2. The location identified by Metcalf & Eddy (1995) and presented in the Final OU 5 RFI/RI Report (K-H 1996) goes through the center of the landfill. This location is based on the Systematic Evaluation Program (Geomatrix 1995). An evaluation of inferred faults in the vicinity concluded that this fault was not capable of generating future earthquakes (Geomatrix 1995). The inferred fault is not expected to disrupt the engineering features or impact the structural integrity of the landfill, and does not appear to impact groundwater hydrogeology.

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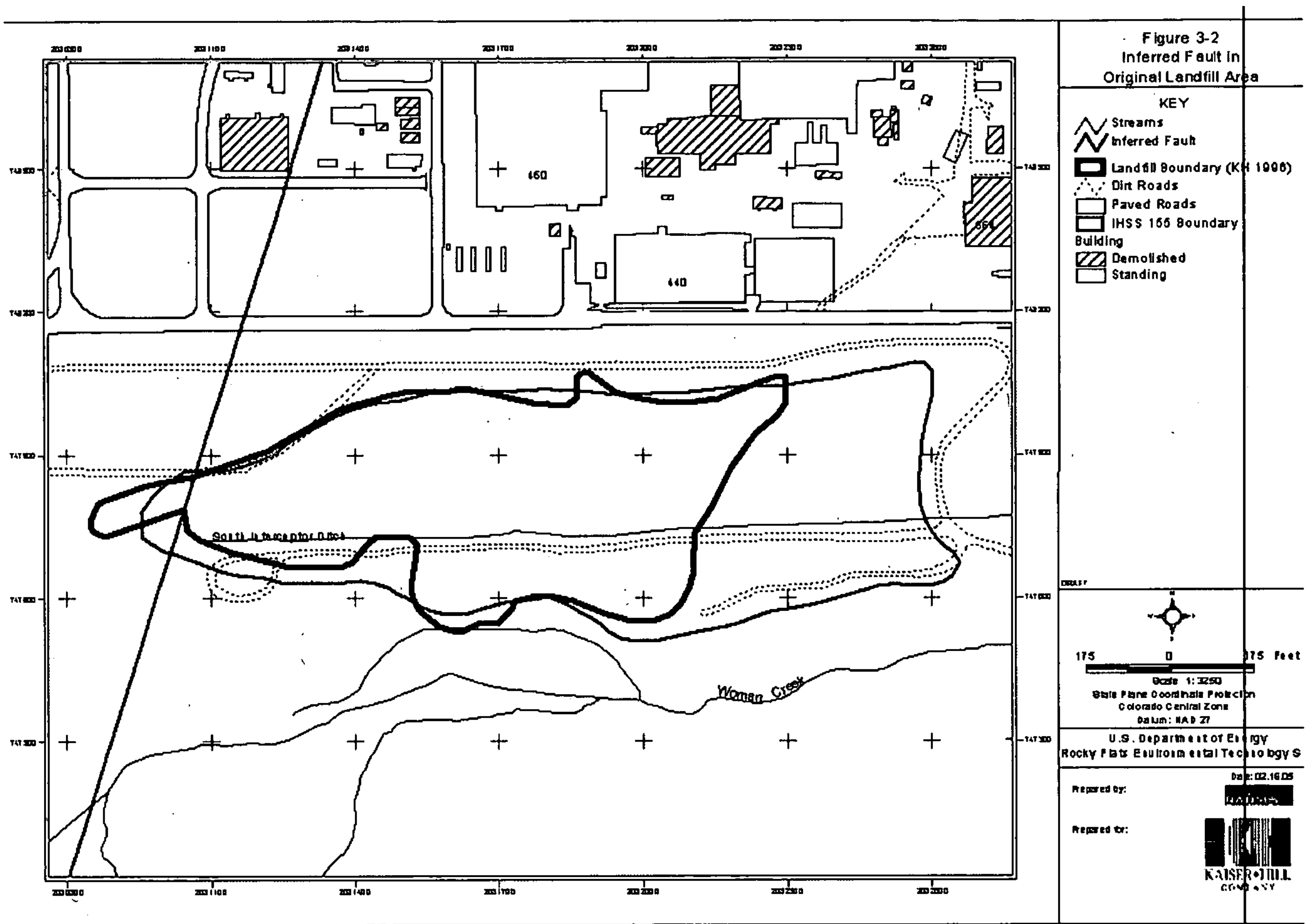
Figure 3-2 Inferred Fault in Original Landfill Area



3.4 Summary of Geotechnical Investigations

A geotechnical investigation conducted at the OLF in 1995 (Metcalf & Eddy, 1995) indicates some uncertainty of the stability of the landfill, and that landsliding of the soils, bedrock and/or waste may be possible. Within the scope and limitations detailed in the 1995 investigation, the work is considered quite thorough and comprehensive. Detailed field investigation of the landfill site was conducted; enabling sound geologic and geotechnical interpretation of site conditions, subsurface materials, and landsliding conditions. However, the laboratory strength testing of samples retrieved from the field investigation appeared somewhat limited, probably due to the preliminary nature of the study and also some sample recovery and disturbance problems in the weaker materials most desired for testing. Critical strength parameters for historical sliding at interface surfaces could not be determined through laboratory testing. Therefore, a back-calculation procedure was used in specific analyses, with an assumed factor of safety of 1.0 at failure for slope geometry and geotechnical parameters. Therefore, to further define the level of landfill stability and to support design of the accelerated action, a topographic survey of the current surface was obtained and a follow-up geotechnical investigation was conducted in 2004. The purpose of this second geotechnical investigation was as follows:

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- Obtain and conduct geotechnical testing on materials that most affect the overall stability of the OLF area;
- Assess the stability of the OLF and underlying soil and bedrock using the new geotechnical data;
- Assess the impact of groundwater on the underlying soil and bedrock stability; and
- Collect the required geotechnical information to design a long-term landfill stability monitoring plan.

The new geotechnical investigation data were also used to assess the structural stability impact of a buttress fill at the toe of the landfill slope. The following paragraphs summarize the follow up geotechnical investigation. A detailed presentation of the geotechnical data and stability analysis can be found in Geotechnical Investigation, Phase 3 Stability Analysis, Technical Support Memorandum (Earth Tech 2004).

There is no current evidence of landsliding or mass movement of the waste fill and soil; however, aerial photographs of the area prior to waste disposal suggest that the pre-landfill slope exhibited signs of previous instability and natural erosion. The current surface is uneven, with areas of sloughing and erosion resulting from historic landslides in the area prior to waste placement, poor waste management practices, and erosion and subsequent slope instability caused by poor surface water controls during and after waste placement operations.

The slope is approximately 90 to 100 ft high, as measured from the base of the landfill to the pediment surface. The upper 40 to 50 ft of the section consists of Rocky Flats Alluvium covered by 10 to 15 ft of waste and soil cover. The remaining 40 to 50 ft of the slope consists of moderately to severely weathered claystone overlain by various thicknesses of waste, constructed fill, and colluvium from past sliding.

The moderately to severely weathered claystone beneath and beyond the toe of the slope varies from 10 to 20 ft in depth and then transitions into unweathered claystone. At and beyond the toe of the slope, the weathered claystone is typically overlain by 5 to 10 ft of alluvium derived from the Woman Creek floodplain.

Groundwater within the slope generally occurs at or slightly above the claystone interface. It is locally higher near the middle of the fill due to ponding in closed depressions behind the fill and the poorly drained SID approximately located one-third the way up the OLF slope.

Waste was generally mixed with Rocky Flats Alluvium materials. The waste/soil matrix varies in consistency and generally consists of a range of silty gravel, clayey sand, and low-plasticity inorganic clay materials. Plasticity index values range from 17 to 31 percent. Effective shear strength values, estimated from soil descriptions, are estimated to be in the range of a friction angle of 30 degrees with a cohesion of 50 pounds per square foot.

Rocky Flats Alluvium is a generally dense, sandy, clayey gravel material with cobbles. However, it sometimes contains beds of stiff to hard clays and sandy clays, as well as fine, medium-dense to very dense clean to clayey sands. Laboratory tests by Metcalf and Eddy

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indicated the presence of low plasticity inorganic clay and high-plasticity inorganic clay materials with the low-plasticity inorganic clay materials having a plasticity index value of approximately 17 percent. Effective shear strength parameters are estimated, from soil descriptions and Metcalf and Eddy laboratory testing, to be in range of a friction angle of 37 degrees.

Colluvium located along and near the toe of the slope consists of a variety of materials from waste, Rocky Flats Alluvium, and weathered claystone materials. Tests by Metcalf and Eddy on clayey colluvium materials derived mainly from the weathered claystone materials indicated the presence of high-plasticity inorganic clay materials with plasticity index values in the range of 31 to 51 percent.

Moderately to severely weathered claystone is predominately classified as a high-plasticity inorganic clay material. Metcalf and Eddy laboratory tests indicated plasticity index values in the range of 30 to 52 percent.

Effective shear strength parameters for the colluvium and weathered bedrock from the recent geotechnical testing estimates a friction angle equal to 20 degrees (drained strength) and 15 degrees (undrained strength). These strengths are the lower bound of all the test data and assume no cohesion. However, these soils do exhibit cohesion ranging from an average of 410 to 510 pounds per square foot.

Tests were not conducted on the unweathered claystone materials because any sliding is expected to occur within the weaker weathered claystone layers above.

A detailed presentation of the geotechnical data and stability analysis can be found in Geotechnical Investigation, Phase 3 Stability Analysis, Technical Support Memorandum (Earth Tech 2004).

3.5 Groundwater

The uppermost groundwater is shallow, unconfined groundwater that occurs within the Rocky Flats Alluvium, colluvial deposits, valley fill alluvium, and weathered Laramie Formation. This water-bearing zone is referred to as the Uppermost Hydrostratigraphic Unit (UHSU) (EG&G, 1995). The UHSU is not an "aquifer" because it is not capable of yielding significant and usable quantities of groundwater to wells or springs (EG&G, 1995b). Soil borings in the Rocky Flats alluvium indicate that groundwater appears hydraulically disconnected from the lower hydrostratigraphic unit (LHSU) groundwater.

Characteristics and dynamics of the UHSU groundwater flow system at RFETS have been described in detail in the former Site-Wide Water Balance (SWWB) modeling work (KH, 2002). Results showed that UHSU groundwater at RFETS typically flows towards the nearest stream. Local flow rates and directions are strongly affected by the hydraulic properties of unconsolidated material, and the morphology and orientation of the underlying claystone bedrock and topographic surfaces. The shallow groundwater system is recharged mostly by direct infiltration of precipitation that is then mostly lost via evapotranspiration. As groundwater moves from higher elevations towards streams, an increasing amount is lost through evapotranspiration, and only a small amount actually contributes as baseflow to streams.

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Groundwater elevations typically vary seasonally less than 5 ft, mostly in response to direct precipitation recharge in wetter periods and evapotranspiration in warmer months. Water levels above the weathered bedrock range from 0 to 5 ft along Woman Creek; below the bedrock in the east-central waste area; 5 to 10 ft in the central waste area; 0 to 5 ft in the western waste area; and from 10 to more than 40 ft above the bedrock north of the OLF.

3.6 Integrated Hydrologic Model Development and Results

A fully integrated hydrologic flow model was developed to support evaluation of several possible closure configurations for the OLF (Integrated Hydro Systems 2004). The approach in developing a model for the OLF is similar to that described in the Site-Wide Water Balance (SWWB) modeling (K-H 2002). Current system flows are first simulated to demonstrate that assumed model parameter values are reasonable. Then specific changes are made in the model to simulate the integrated hydrologic system response to closure configuration modifications. The MIKE SHE code, developed by the Danish Hydrological Institute, is used to simulate integrated flows at the OLF. The code couples subsurface flows, unsaturated and saturated zone, with surface flows, overland and channel flow. Effects of evapotranspiration and snowmelt are also considered in the model, and output is generated subhourly over a full year.

Available geologic, hydrologic, and chemical data in the OLF and surrounding area were reviewed and then compiled into a spatial Geographic Information System (GIS) database to support model development. Most of this information was obtained from the former SWWB modeling, although several new datasets were prepared. Available field geologic borehole logs were carefully reviewed to define approximate waste and bedrock surface contacts. Recent logs for the area, along with a higher-resolution surface topography, were then used to construct more accurate weathered and unweathered bedrock surfaces in the OLF area than previously prepared (K-H 2002). Refinement of the weathered bedrock surface is important because this was found to strongly control groundwater flow gradients and levels in hillslope areas.

Thicknesses of unconsolidated material from the Building 440 area, south through the waste to Woman Creek, range from over 20 to less than 5 ft. Thickness of the waste material is also variable, ranging from less than 5 ft in the east-central area to more than 12 ft to the west. The weathered bedrock thickness is generally about 20 ft through the OLF area.

More than 10 years of groundwater level data in the area, including recent 2004 data, were also reviewed. Groundwater level fluctuations within the OLF range from 5 to 10 ft over the year, reflecting seasonal recharge, evapotranspiration and drainage effects. The difference in magnitude of groundwater fluctuations between the waste and non-waste areas suggests that unsaturated and saturated zone hydraulic properties are different in the two areas. Groundwater depths in the UHSU range from about 20 to 30 ft below ground near the Building 440 area on the mesa to about 15 ft below ground within the waste, to less than about 5 ft below ground along Woman Creek. In the Lower Hydrostratigraphic Unit (LHSU) wells in the OLF area groundwater depths are significantly lower than in nearby UHSU wells (57194, 71194 are greater than 100 ft, suggesting the LHSU and UHSU are hydraulically disconnected in the area. Finally, a potentiometric surface map constructed using time-averaged water level information indicates there is a west-east groundwater divide just north of Building 444. Therefore, groundwater south of this divide slowly flows toward Woman Creek.

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Several steps were involved in constructing the integrated flow model. First, a 25-ft numerical grid was prepared to better simulate local flow conditions associated with the OLF (a 200-ft grid resolution was used in the SWWB model.) Several GIS techniques were used to then convert spatial hydrogeologic GIS information onto the finer grid. Spreadsheet algorithms were then used to convert gridded GIS information into model input. Unsaturated and saturated zone hydraulic properties determined through integrated model calibration conducted for the original SWWB model and subsequent VOC fate and transport modeling (K-H 2004) were specified in the localized model. However, new values for drain conductances and hydraulic properties for the waste had to be determined through initial OLF model simulations.

The integrated model of the current system configuration, using climate data from October 1999 through September 2000 reproduces observed flow conditions well. Model simulations require that the Water Year (WY) 2000 climate sequence is cycled for three consecutive years to stabilize effects of prescribed initial conditions. Model performance is assessed by comparison of simulated and observed time-averaged water levels at well locations within the model area. Results indicate that average difference between simulated and observed levels within the OLF is less than one foot, and over the model area differences are just over a foot. At some well locations differences are greater than one foot, which can be attributed to local scale effects not captured by the resolution of the model. Simulated annual surface flow at gage GS22, though less than observed, indicates most surface events are captured in peak flow, timing of events, snowmelt and baseflow. Additional adjustment of drain conductances would only improve the comparison between observed and simulated surface flows. Ultimately, the drain conductance values are not important in evaluating impacts of closure configurations on system flows because the drains are removed in these simulations.

Several closure configurations were evaluated as summarized below, including assumptions:

- Scenario 1 – IA Regrade-only
    - IA undergoes closure configuration (as per above)
    - No changes made to existing OLF area,
    - Typical climate year sequence assumed (WY2000).
- Scenario 2 – IA & OLF Regrade
    - IA undergoes closure configuration (as per above)
    - OLF area is regraded,
    - OLF area is re-vegetated,
    - Fill material is used as part of regrade (assume Qrf),
    - Typical and Wet Year (100-year basis) climate year sequences are assumed.
- Scenario 3 – IA & OLF Regrade, Fill Buttress, and Drain
    - Same as Scenario 2,
    - Includes Fill Buttress and Drain on Upgradient side.

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- Typical climate year sequence assumed (WY2000)

- Scenario 4 – IA & OLF Regrade, Fill Buttress, Drain, and Slurry Wall
  - Same as Scenario 3, but includes slurry wall immediately north of the waste area footprint.

Scenario 1 was simulated to show the relative effects of regrading the OLF for a typical climate year sequence (that is, WY2000). Within the OLF, simulated average-annual groundwater levels change less than one foot. Locally they adjust less than three feet. The west-central area generally increases, while the east-central area tends to decrease in response to IA closure modifications. For example, pavement, buildings, drains and water supply lines are removed and then the IA is regraded and revegetated.

In Scenario 2 (basecase) OLF closure configuration scenario, both the IA and OLF are reconfigured. North of the OLF, the IA is closed as described above. Within the OLF, the ground surface is regraded and assumes a mature stand of vegetation. Regrading the OLF surface causes areas within the OLF waste to be filled up to 20 to 30 ft, and cut up to 20 ft. As a result, the depth to bedrock becomes both shallower and deepens throughout the OLF waste area, causing adjustments in groundwater levels in the area. Both a typical and 100-year wet-year climate sequence are simulated to show average hydrologic conditions within the model area as well as conservatively high levels.

Results of simulating the OLF regrade show an average increase in groundwater levels over the IA. Locally, levels increase up to seven feet and decrease less than 4 feet. The model also shows that average annual simulated depths in shallow bedrock areas rise to near ground surface (west-central area) for typical climate conditions. For wetter periods of a typical climate year, groundwater can discharge as seeps to the ground surface. Depths are greatest toward the eastern and western ends of the waste area because these areas represent fill areas associated with the regrade. Saturated heights above the weathered bedrock surface increase from 3 to 7 feet compared to Scenario 1. A water balance of the waste area to unweathered bedrock indicates that most of the direct precipitation infiltrates the surface soil, and then either evapotranspires or enters the groundwater system as recharge. Model results also show that variability in groundwater levels and flow within the hillslope are controlled by direct recharge and evapotranspiration, rather than by lateral inflow. Most of the discharge from the OLF occurs by evapotranspiration rather than lateral subsurface flow.

In the wet-year climate sequence average annual groundwater levels increase 0 to slightly more than 1 foot over the waste area. This increases the saturated heights above the weathered bedrock a similar amount.

In the third scenario, effects of adding the fill buttress and upgradient drain have a limited affect on upgradient groundwater levels. For example, levels decrease an average of less than one foot over the waste area, but locally decrease more than 10 feet along the drain assumed to extend to the top of the weathered bedrock. Simulated drain discharge rates are less than 1 gpm. Effects of adding a slurry wall in the fourth scenario down to the top of the weathered bedrock also show only limited effects on both upgradient and downgradient groundwater levels. Average levels

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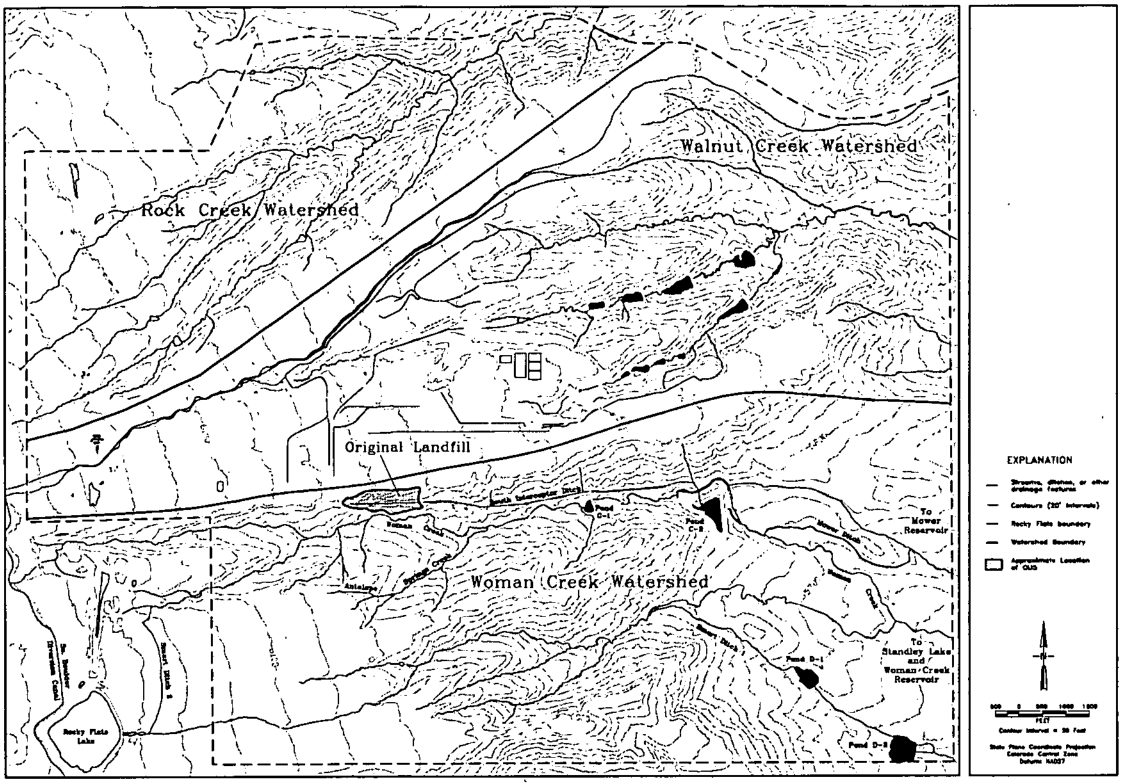
within the OLF decrease less than one foot. Locally, levels on the upgradient side increase less than three feet, and levels on the downgradient (south) of the slurry wall decrease less than three feet. The areal extent of change due to the slurry wall ranges from about 200 to 300 ft on either side.

3.7 Surface Water

The OLF is located within the Woman Creek drainage basin, which extends eastward from the base of the foothills near the mouth of Coal Creek Canyon to Standley Lake (Figure 3-3). The long-term average annual yield generated by this basin is 32.1 acre-ft, with average storms producing surface flows of 4 to 7 cubic ft per second (cfs). During extreme precipitation events (greater than the 15-year return occurrence based on precipitation), surface flows up to 40 cfs have been generated. Although seasonal flows can be low, Woman Creek receives continuous flow from Antelope Springs Creek. The reach of Woman Creek adjacent to the OLF is a gaining reach of stream (groundwater discharges to surface water); however, this inflow is likely due to inflow from the southern side of the valley and seepage from the old orchard area (Kaiser-Hill 1996).

The Woman Creek drainage basin has an artificial water control structure, the South Interceptor Ditch (SID), which intercepts runoff and routes it to Pond C-2. This runoff would normally flow into Woman Creek or percolate into the underlying subsurface materials of the basin. The Woman Creek diversion dam routes all Woman Creek flows less than the 100-year flood peak around Pond C-2 (Kaiser-Hill 1996). With the completion of the Woman Creek Reservoir, located just east of Indiana Street and operated by the Woman Creek Reservoir Authority, Woman Creek flows are detained in cells of the reservoir until the water quality has been ensured by monitoring of RFETS discharges via Woman Creek Reservoir into the Walnut Creek Drainage below Great Western Reservoir.

Figure 3-3 Surface Water Features



In the past, most natural flows in Woman Creek were diverted to Mower Reservoir and did not exit RFETS via Woman Creek. This is no longer the case. The Mower Ditch headgates were upgraded, and water in Woman Creek leaves RFETS via Woman Creek (at GS01) and enters the Woman Creek Reservoir. In the past, water from Pond C-2 (located off-channel in the Woman Creek drainage) was sampled and then pumped to the off-site Broomfield Diversion Ditch. Currently, RFETS discharges water from Pond C-2 directly into Woman Creek via a pump (at GS31); the water then flows to the Woman Creek Reservoir.

3.8 Ecological Setting

Even though the OLF is a highly disturbed industrial site, the area includes the Preble's Meadow Jumping Mouse (PMJM) protection area and wetland areas associated with surface water in the area. PMJM is listed as threatened by the U.S. Fish and Wildlife Service (USFWS). This listing provides special protection for the species under the Endangered Species Act, and potential remedial actions at the OLF must be evaluated for potential impacts to PMJM.

PMJM have been identified in all the major drainages of RFETS: Rock Creek, Walnut Creek, and Woman Creek, and the Smart Ditch drainages. Native plant communities in these areas provide a suitable habitat for this small mammal. PMJM at RFETS are restricted to riparian areas and pond margins, apparently requiring multistrata vegetation with abundant herbaceous cover. PMJM populations at RFETS are found in association with the riparian zone and seep wetlands across RFETS. The vegetation communities that provide PMJM habitat include the

Great Plains riparian woodland complex, tall upland shrubland, wetlands adjacent to these communities, and some of the upland grasslands surrounding these areas. Recent studies have produced a better understanding of population centers of the species, and studies over the past several years have provided data to help estimate numbers of individuals within each population unit (RFETS 2000).

PMJM have been captured along Woman Creek in the area of the OLF where a significant amount of suitable habitat occurs. The PMJM were captured in riparian areas with well-developed shrub canopies and a relatively lush understory of grasses and forbs. This is typical of habitats occupied by the subspecies throughout its range (Kaiser-Hill 1996). The PMJM habitat and buffer area (Figure 3-4) includes a portion of the OLF area below the SID. The PMJM habitat and buffer area continues east-west along Woman Creek.

Jurisdiction wetlands in the OLF area are also shown on Figure 3-4, and include the area directly surrounding the SID. South of the landfill, wetland areas are associated with springs and riparian fringe in the Woman Creek drainage. The SID wetlands were created when the ditch was built, and may be considered isolated wetlands. The SID wetlands is a narrow, linear system, dominated by cattails and coyote willows and, as such, has lower functional integrity than the natural wetlands associated with Woman Creek.

Surface water flows in Woman Creek are typically low and permanent with discharge sustained primarily from ground water seeps. Past aquatic surveys have documented the presence of the following fish species at different times: central stoneroller, fathead minnow, golden shiner, white sucker, green sunfish, and largemouth bass (DOE 2003). Common macroinvertebrate organisms found in Woman Creek include species from the following groups: Oligochaeta (aquatic worms), Amphipoda (scuds), Ephemeroptera (mayflies), Diptera (flies), and Gastropoda (snails; DOE, 2003).

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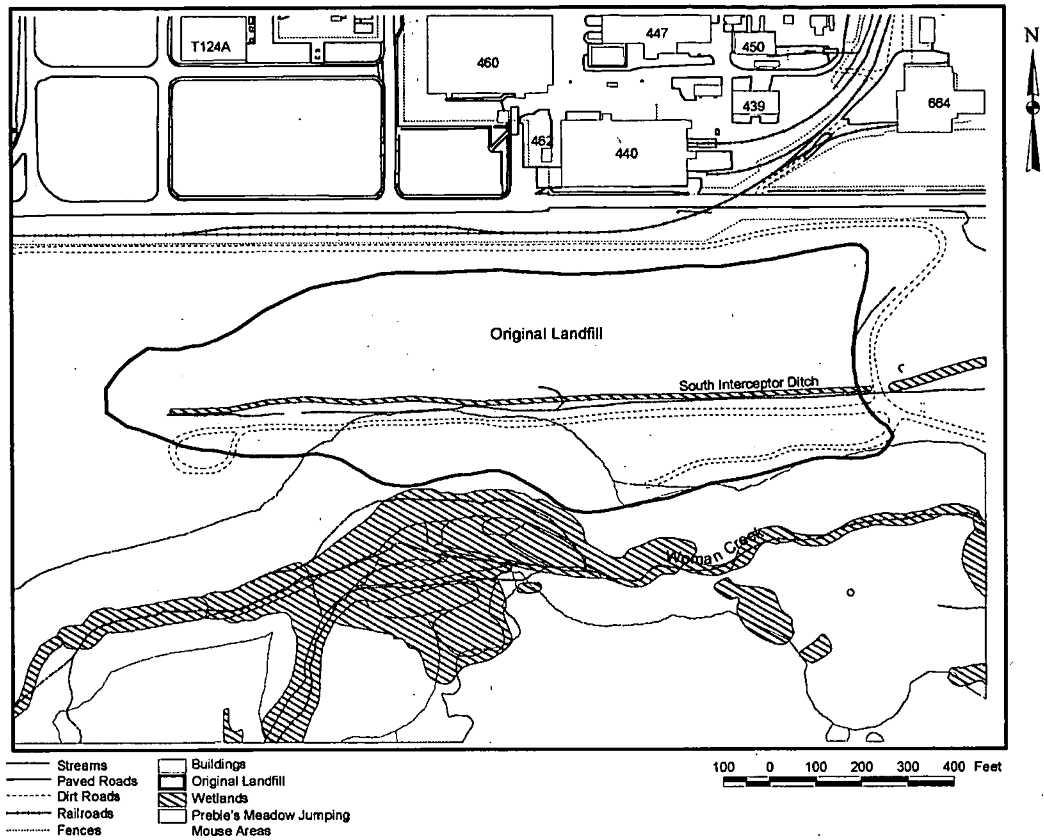
Figure 3-4 Wetlands and PMJM Areas Near the Original Landfill



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4.0 ENVIRONMENTAL DATA SUMMARY AND RFCA ACTION LEVEL COMPARISON

This section summarizes environmental data that have been collected at the OLF for surface soil, subsurface soil, groundwater, surface water, and sediment. Analyte concentrations are compared to Site background levels to determine potential contaminants, and are compared to RFCA Action Levels (ALs) to render accelerated action determinations in accordance with *RFETS Action Levels and Standards Framework for Surface Water, Ground Water and Soils*, RFCA Attachment 5 (ALF).

4.1 Site Characterization Data

The data used to characterize the nature and extent of contamination in and around the OLF were collected primarily in the early 1990s and are documented in the Final Draft Operable Unit 5 (OU 5) Phase 1 Remedial Investigation/RCRA Facility Investigation (OU-5 Phase 1 RI/RFI) (Kaiser-Hill 1996). The OLF coincides with OU-5 Phase 1 RFI/RI Area of Concern 1 (see Figure 2-1).

Additional sampling of groundwater and surface water at or in the proximity of the OLF has occurred since that time. This additional sampling and analysis was planned and documented in accordance with the RFCA Integrated Monitoring Plan (IMP) (DOE et al. 1997). The RFCA Parties evaluate the IMP annually for adequacy and changes based on previous monitoring results, and changed conditions; planned activities and public input are made with the approval of CDPHE and EPA.

The scope of the OU 5 Phase 1 RFI/RI is presented in the OU 5 Phase 1 RFI/RI Work Plan (OU 5 Work Plan) (EG&G 1992). The OU 5 Work Plan includes the rationale for the number and location of samples. It was reviewed by EPA and CDPHE and subsequently approved and issued on February 28, 1992. Development of the OU 5 Work Plan included a Data Quality Objective process to describe the quantity and quality of data required. Data needs were identified to characterize the physical and hydrogeologic setting, assess the presence of contamination at each site, characterize the nature and extent of contamination, and support the evaluation of remedial alternatives based on effectiveness, implementability, and cost. The type, number, and location of samples were based on meeting these needs. Results of these investigations are contained in the 1996 RFI/RI Report for the OU 5 Woman Creek Priority Drainage (Kaiser-Hill 1996).

Sampling locations were selected based on earlier investigations and reviews of historical records, which included earlier groundwater and surface water analytical data, aerial photographs, site records, a magnetometer survey, and radiation surveys. All sampling and analysis activities were conducted in accordance with the Quality Assurance requirements of the OU 5 Work Plan. Data gaps were identified based on results of the earlier investigations, and additional sampling and geotechnical investigation was performed to fill these gaps.

The RFI/RI sampling program resulted in the following data related to the OLF:

- Surface soil: 7,568 validated analyses from 70 surface locations;
- Borehole samples to bedrock: 24,964 validated analyses from 175 soil samples;

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- Groundwater: 31,171 validated analyses from 213 samples from 50 wells; and
- Surface water: 25,384 validated analyses from 15 locations.

Investigations also included geotechnical evaluations, groundwater investigations, hydrogeologic testing, storm sewer sampling, and air monitoring. Other investigations conducted in the same time frame included the following:

- Field Instrument Detection Low Energy Radiation and High Purity Germanium gamma radiation surveys to detect and identify near-surface areas of contamination from radioactive materials;
- Magnetometer survey to locate ferrous materials and anomalies;
- Electromagnetic survey to delineate dump boundaries, saturated materials, and anomalies;
- Cone penetrometer tests to gather geotechnical information on the waste fill, alluvium, and bedrock.; and
- Soil gas survey for VOCs and combustible gases to locate possible sources of these constituents.

4.2 Data Compilation and Evaluation

The OU 5 Phase 1 RFI/RI Report fully compiles, discusses, and evaluates the results of all sampling activities at the OLF, as well as downslope/downgradient of the OLF. To simplify and focus the evaluation of the source containment presumptive remedy, only the RFI/RI analytical data that are directly relevant to the OLF IHSS were used in the action level comparison. These data include OU 5 RFI/RI surface and subsurface soil data for all sample locations within or immediately adjacent to the IHSS (Figures 4-1 and 4-2), groundwater data for Upper Hydrostratigraphic Unit (UHSU) wells within and downgradient of the IHSS (Figure 4-3), and surface water and sediment data for Woman Creek and the South Interceptor Ditch sampling locations closest to the IHSS (Figures 4-4 and 4-5). Groundwater and surface water data also include data that have been collected since the RFI/RI during routine sampling in accordance with the IMP. All data were extracted from the RFETS Soil Water Database (SWD).

Analytical data for surface soil (ending depth for the sample interval is 6 inches or less), subsurface soil (ending depth for the sample interval is greater than 6 inches), groundwater, surface water, and sediment have been compared to RFETS background levels. Background levels for metals and radionuclides in subsurface soil (geologic material of the UHSU), groundwater (total and dissolved[1] concentrations for the UHSU), surface water (total and dissolved concentrations for streams), and sediment are from the Background Geochemical Characterization Report (DOE 1993). Background values for surface soil are from the Geochemical Characterization of Background Surface Soils: Background Soils Characterization Program (DOE 1995). Because of difficulties in determining the appropriate background concentrations for organic compounds, any detection of an organic compound is considered an above-background observation. Results were determined to be "detect" or "nondetect" based on the result qualifier flags supplied by the laboratory.

The OLF data are summarized in Tables 4-1 through 4-7 for surface soil, subsurface soil, groundwater, upgradient Woman Creek surface water (stations SW039, SW040, SW041, and

[1] For water, samples were split into "dissolved" and "total" based on whether the samples were filtered.

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SW506), downgradient Woman Creek surface water (stations SW032, SW033, SW10295, SW50193, and SW50293), SID surface water (stations INT. DITCH, SW036, SW038, SW129, and SW500), and sediment (stations INT. DITCH, SW036, SED506, SED507, SED41400, and SED51693), respectively. These summary tables present only those analytes that were detected above background and the Method Detection Limit[2] in order to limit the tables to analytes that are potentially contaminants at the OLF. The tables provide a comparison with action levels from RFCA, Attachment 5. The entire analytical program for the samples addressed in Section 4.0 is summarized in Appendix C and the entire environmental data set is provided in Appendix D.

4.3 Surface Soil

As detailed in Table 1 of Appendix C, surface soil samples were analyzed for metals, radionuclides, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, and PCBs. As shown in Table 4-1, metals, radionuclides, and organic compounds have been detected above background levels in surface soil; however, only uranium and a few polynuclear aromatic hydrocarbons (PAHs) are present in surface soil above the RFCA ALs.

Uranium contamination is present in surface soil above the ALs at four sample locations. As shown on Figure 4-6, one sample location is on the northwestern boundary of the OLF. This area was initially identified by gamma radiation surveys, which indicated it was a small, localized area of contamination. The uranium contamination at this location coincides with the action discussed in Section 2.5 for debris that became exposed at the surface in April 1990, which was surveyed and determined to be contaminated with depleted uranium. It was further investigated in accordance with the OU-5 Work Plan.

The other three sample locations where uranium concentrations are above the ALs are at the center of the landfill (Figure 4-6). Elevated gamma radiation in this area was initially identified by the 1990 gamma radiation survey and was further investigated in accordance with the OU 5 Work Plan. The OU 5 Work Plan gamma survey identified nine areas of elevated radiation roughly bounded by the surface soil locations with the above AL uranium concentrations. As discussed in Section 2.5, debris was removed from this area in May 1993 during the OU 5 gamma survey. The uranium contamination at this location could also be a remnant of the depleted uranium cleanup operation that occurred in response to the dumping of 60 kg of burnt depleted uranium, as discussed in Section 2.2.

Examination of the uranium isotope concentrations shown on Figure 4-6 indicates that the four sample locations with uranium isotope concentrations above the ALs have a uranium-238/uranium-234 activity ratio of approximately 10, which is indicative of depleted uranium.[3]

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[2] For the Section 4 summary tables, an analyte is not listed if the maximum concentration does not exceed background and the Method Detection Limit (MDL) listed in Appendix E of the Industrial Area and Buffer Zone Sampling and Analysis Plan (IABZSAP) (DOE 2004). This MDL may differ from the reported sample MDL. The IABZSAP MDLs are considered representative of what most laboratories can achieve and have been used because the MDL originally reported could have been either an Instrument Detection Limit (IDL), MDL, or Reporting Limit (RL) (supporting documentation is unclear). A "U qualified" result is always considered a non-detect regardless of whether the value exceeds the IABZSAP Appendix E MDL because the laboratory reported it as a nondetect.

3 The U238/U234 ratio of 10 is based on the weight fractions of the isotopes in depleted uranium as provided in the 1988 DOE Publication1 "Health Physics Manual of Good Practices for Uranium Facilities" (Bryce et al. 1988). They are as follows: uranium-238 – 0.9975; uranium-235 – 0.0025; uranium-234 – 0.000005. These were converted to activity fractions using the specific activities of the isotopes. The activity fractions are as follows: uranium-238 – 0.903; uranium-235 – 0.015; and uranium-234 – 0.083. As can be seen, the uranium-238/uranium-234 activity ratio is approximately 10.

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The other above-background concentrations of uranium in the area have associated uranium-238/uranium-234 activity ratios that are lower, in some cases as low as approximately 1, which is indicative of natural uranium.

Surface soil removal and confirmation sampling were conducted in July 2004 at these four locations with uranium isotope concentrations above the ALs. A description of the soil removal and confirmation sample results are presented in Appendix C.

With respect to the PAHs, as shown on Figure 4-7, these compounds are ubiquitous in surface soil at the OLF. However, two sampling locations have PAH concentrations that exceed the ALs, and one of these locations shows an exceedance with a wide margin above the AL (benzo[a]-pyrene at SS10593). PAHs are largely confined to the surface (Section 4.4), likely due to PAH-contaminated runoff from paved areas in the IA that contacted the soil or from the dumping of street sweeping materials on the surface of the OLF, as discussed in Section 2.2.

4.4 Subsurface Soil

As detailed in Table 1 of Appendix B, subsurface soil samples (soil mixed with buried waste) were analyzed for metals, radionuclides, VOCs, SVOCs, pesticides, and PCBs. As shown in Table 4-2, metals, radionuclides, and organics have been detected above background levels in subsurface soil; however, only PAHs were detected above the ALs. PAHs were detected in subsurface soil in a relatively isolated location as shown on Figure 4-8. Unlike the widespread detection of PAHs in surface soil that probably indicates runoff from asphalt-paved areas in the IA as a potential source, the isolated occurrence of PAHs in subsurface soil appears to indicate the presence buried wastes and possibly asphalt and street sweepings.

4.5 Groundwater

As detailed in Table 2 of Appendix B, groundwater samples were analyzed for metals, radionuclides, VOCs, SVOCs, pesticides, PCBs, and water quality parameters (WQPs). Seventeen years of data exist for radionuclides, VOCs, and WQPs (1986 to 2003). There are metals data from 1991 to 2003, and SVOC and PCB/pesticide data mostly from 1991 to 1995. The SVOC and PCB/pesticide data collection was discontinued because these compounds were largely not detected. As shown in Table 4-3, metals, radionuclides, and organic compounds have been detected in groundwater at concentrations above background and the Tier II ALs.[4] However, the number of detections above background and the Tier II ALs was generally very low for all of these constituents, and their concentrations were also generally very low relative to background and the Tier II ALs. This is further evaluated below.

4.5.1 Metals

Antimony, beryllium, cadmium, lead, manganese, nickel, selenium, and thallium were detected above the Tier II AL at least once in groundwater at the OLF (Table 4-3). Metal concentrations

[4] Dissolved concentration data are presented in Table 4-3 for metals and radionuclides because these data are representative of the mobile fraction of these constituents in groundwater. Total concentration data are presented for organics because these samples are not field filtered in accordance with standard operating procedures.

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did not exceed the Tier I AL. The metal concentration distributions over time for those wells where there was one or more detections above the Tier II ALs are discussed below.

Antimony As shown on Figure 4-9, wells 5786, 59593, and P416689 had concentrations of antimony that were above the Tier II AL. However, concentrations were above background only once for each well, and the most current data for each well indicate concentrations were below the Tier II AL.

Beryllium Figure 4-10 indicates well 7086 had concentrations of beryllium that were above the Tier II AL. There were two occurrences in the late 1980s and all subsequent measurements have been non-detects or at trace levels well below the Tier II AL.

Cadmium Figure 4-11 shows that wells 7086 and 10994 had concentrations of cadmium that were above the Tier II AL. There was one occurrence in each well in the early to mid-1990s and all subsequent measurements have been nondetects or at trace levels well below the Tier II AL.

Lead Figure 4-12 indicates well 5786 had a concentration of lead that was above the Tier II AL. There was one occurrence in 1990 and all subsequent measurements have been nondetects or at trace levels well below the Tier II AL.

Manganese As shown on Figure 4-13, four wells had manganese concentrations above the Tier II AL. With the exception of well 59493, each well had concentrations that were either inconsistently above the Tier II AL or within a factor of 2 of the Tier II AL. Manganese concentrations in groundwater at well 59493 had consistently exceeded over the Tier II AL, and the concentration was over 10 mg/L in 1993. However, subsequent measurements indicate the concentrations are within a factor of 2 of the Tier II AL (approximately 3 mg/L).

Nickel As shown on Figure 4-14, four wells had nickel concentrations above the Tier II AL. However, for two of these wells (5786 and P416689), the concentrations were inconsistently above the Tier II AL. For the other two wells (57994 and 58194), there was only one sample for each well, and the concentrations were within the range seen at well P416689, which is an upgradient well.

Selenium As shown on Figure 4-15, two wells had selenium concentrations above the Tier II AL. The concentration in well 59793, located within the OLF, was just above the Tier II AL (and background); this was the only sample for this well. The other location where the selenium concentration was above the Tier II AL is well 10994, an IMP Plume Extent monitoring well, located east of the OLF (Figure 4-3). As shown on Figure 4-15, dissolved selenium concentrations were relatively high, averaging approximately 0.6 mg/L. These concentrations are 10 times the Tier II AL and background. Well 10994 is sidegradient to the OLF. Therefore, the OLF does not appear to be the source for the selenium observed at this location.

Thallium As shown on Figure 4-16, eight wells had thallium concentrations above the Tier II AL. However, in every well, rarely did the concentrations exceed background (background is over 2 times higher than the Tier II AL), and every above-background concentration was within a factor of 2 of the background value.

4.5.2 Radionuclides

Americium-241, strontium-90, uranium-235, and uranium-238 were detected above background and the Tier II AL at least once in groundwater at the OLF (Table 4-3). Uranium-234, plutonium-239/240, radium-226, radium-228, cesium-137, and tritium were not detected above background and the Tier II AL. Because americium-241 was only detected above the Tier II AL (and background) once in 26 samples, and at a relatively low activity (0.74 pCi/L), the occurrence of this radionuclide in groundwater at the OLF is not evaluated further[5]. The activity distributions over time for the other radionuclides in wells that had one or more detections above the Tier II ALs are discussed below:

Strontium-90 As shown on Figure 4-17, five wells had strontium-90 activities above the Tier II AL. However, in all the wells, the concentrations were inconsistently above the Tier II AL, and the most recent samples had activities below the Tier II AL.

Uranium Uranium-235 exceeded background and the Tier II AL, and uranium-238 exceeded background and the Tier I AL in well 61093. Uranium isotope concentrations in all other wells were below background.

To further evaluate whether the uranium in groundwater is naturally occurring, the total uranium concentrations (sum of uranium-234, uranium-235, and uranium-238) and the U-238/U-234 activity ratios for well 61093 were plotted (Figure 4-18). As shown on Figure 4-18, a trend of increasing U-238/U-234 ratio with increasing concentration exists, which indicates the presence of depleted uranium. (Depleted uranium has a U-238/U-234 activity ratio of approximately 10, whereas natural uranium has an activity ratio of approximately 1.) On Figure 4-19, the total uranium concentrations and the U-235/U-238 mass ratios are plotted. (The U-235/U-238 mass ratios were calculated from alpha spectrometer data for the two uranium isotopes.) This figure indicates the U-235/U-238 mass ratio decreased significantly when the total uranium concentration increased significantly. This also suggests the presence of depleted uranium because natural uranium has a U-235/U-238 mass ratio of 0.0072, and ratios significantly less than this value indicate a lesser proportion of uranium-235 is present, that is, depleted uranium.

As part of a Sitewide study on the occurrence of uranium in groundwater, sample from wells 59393, 59793, and 61093 were collected and analyzed for uranium-234, uranium-235, uranium-236, and uranium-238 using Inductively Coupled Plasma/Mass Spectrometry (ICP/MS) (data not included in Table 4-3). This analytical method provides uranium isotope concentrations in parts per billion (ppb). Samples from these three wells were collected on June 22, 1999, December 7, 1999, February 8, 2000, and June 12, 2000. The average total uranium concentrations and the average uranium-235/uranium-238 mass ratios are plotted for these wells on Figure 4-20. The results indicate the average total uranium concentrations were low in wells 59393 and 59793 (< 100 ppb), and the average uranium-235/uranium-238 mass ratio was approximately 0.0072, indicating the presence of natural uranium. In contrast, in well 61093, the average total uranium concentration was much higher (approximately 600 ppb or 200 pCi/L),[6] and the average

[5] The single occurrence of americium-241 above the Tier II AL was in well 7086, a downgradient well. It occurred during the first sampling of the well in 1987; the four subsequent samples from the well indicated nondetectable americium-241 activities.
[6] Dissolved concentration data were not collected in 1999 and 2000. Therefore, the results presented on Figure 4-20 (total concentrations in 1999 and 2000) cannot be compared to results presented in Figures 4-18 and 4-19 (dissolved concentrations in 1995).

uranium-235/uranium-238 ratio was much lower (0.0024), indicating depleted uranium is the source of the observed higher uranium concentrations. Also, uranium-236 was not detected in wells 59393 and 59793, but was detected in the groundwater samples from well 61093. The uranium-236 concentrations reported for the sample collection dates noted above were 0.015 ppb, 3.701 ppb, 0.027 ppb, and 0.017 ppb, respectively. Because uranium-236 is not a naturally occurring isotope of uranium, this further suggests the presence of depleted uranium at well 61093.

Considering the above results and the location of well 61093 within the bounds of the depleted uranium "hot spot" in surface soil, the "hot spot" appears to be the source of the depleted uranium contamination in groundwater. However, for perspective, it is noted that the dissolved uranium concentrations at well 61093 are at or near background concentrations (approximately 100 pCi/L of dissolved uranium).

4.5.3 Organics

Table 4-3 indicates that organic compounds, primarily chlorinated solvents, are occasionally detected in groundwater in or near the OLF, generally at very low concentrations (<10µg/L). Compounds with concentrations that have been above the Tier II AL include dieldrin, bis(2-ethylhexyl)phthalate, 1,1,2,2-tetrachloroethane, 1,1-dichloroethene, methylene chloride, tetrachloroethene (perchloroethene or PCE), and trichloroethene (TCE). The organic compound concentration distributions over time for those wells that had one or more concentrations above the Tier II AL are discussed below. (Note that the concentration distributions over time for 1,1,2,2-tetrachloroethane and 1,1-dichloroethene are not shown or discussed because only a single occurrence above the Tier II AL for each compound was detected, and the concentrations were less than 10 µg/L.[7]) The concentration distribution over time for methylene chloride is also not shown because the seven concentrations above the Tier II AL are isolated occurrences in seven different wells. Methylene chloride is also a common laboratory contaminant.

<u>Dieldrin</u> Four occurrences of dieldrin, a pesticide, were reported at concentrations above the Tier II AL. As shown in Figure 4-21, all four occurrences were in well 10994, and they represent all the dieldrin data for this well. The data were collected in 1994 – 1995, and they appear to indicate a decreasing concentration trend. Regardless, the well is sidegradient (to the east) of the OLF (see Figure 4-3) and, therefore, the OLF is not the source of the apparent dieldrin contamination.

<u>Bis(2-ethylhexyl)phthalate</u> Bis(2-ethylhexyl)phthalate was detected above the Tier II AL in wells 58194, 59393, and 59493 (Figure 4-22). The three exceedances are not representative of the balance of the data at these wells, which indicate the compound is rarely detected or detected at a very low level below the Tier II AL. Furthermore, the qualifier code on the data for the three concentrations above the Tier II AL indicates the compound was detected in the laboratory blanks. It is concluded that the OLF is not a source for bis(2-ethylhexyl)phthalate in groundwater.

[7] 1,1,2,2-Tetrachloroethane was detected in well 58094 at a concentration of 3 µg/L in 1994. This compound was not detected in this well again, or in any other well at the OLF. The 1,1-dichloroethene concentration above the Tier II AL was for a sample collected from well 61093 in 1993 (31 µg/L). Two subsequent samples from this well in 1995 contained 1,1-dichloroethene concentrations of 5 µg/L and nondetected.

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Tetrachloroethene As shown on Figure 4-23, seven wells contained PCE concentrations above the Tier II AL (see Figure 4-3 for well locations). In three of the wells (60893, 63193, and P416689), the PCE concentrations were near or below the Tier II AL over time. Because P416689 is an upgradient well (to the north, up the hillside [see Figure 4-3]), it appears the source of this low-level PCE contamination is the IA. The four other wells at the OLF with PCE concentrations above the Tier II AL had significantly higher levels of this VOC. Three of these wells are located within the OLF (58693, 59194, and 59794 [west-northwest of the OLF center]). There is one data point each for wells 58693 and 59794, and three data points for well 59194. Concentrations of PCE are in the 8 to 150 μg/L range. The fourth well with significantly higher PCE concentrations (62893) is located sidegradient of the OLF (to the east) and has an apparent steadily increasing concentration of PCE in the same concentration range noted above. Because of the sidegradient position of the well, it appears the source of the PCE contamination at this location is the IA. In summary, PCE contamination in groundwater at the OLF results from IA activities; there may be additional minor PCE contamination arising from the OLF.

Trichloroethene Similar to the occurrence of PCE in groundwater, eight wells contained TCE concentrations above the Tier II AL (Figure 4-24) (see Figure 4-3 for well locations). In five of the wells (20697, 59594, 62893, 63193, and P416689), TCE concentrations were near or below the Tier II AL over time. Because 62893 is a sidegradient well and P416689 is an upgradient well [see Figure 4-3]), it appears the source of this low-level TCE contamination is the IA. The three other wells (60993, 61093, and 59794) contained significantly higher concentrations of TCE. Although well 61093 had a maximum TCE concentration of 140 μg/L, the concentrations continually dropped off in the subsequent three sampling events at this well, with only 2 μg/L of TCE reported in the last sample collected from this well (June 2004). There is one datum for well 60993 (85 μg/L) and well 59794 (20 μg/L). In summary, TCE contamination in groundwater at the OLF arises from the IA, and there may be additional minor TCE contamination arising from the OLF.

4.5.4 Water Quality Parameters

Nitrate was the only WQP with concentrations above the Tier II AL. As shown on Figure 4-25, nitrate was detected above the Tier II AL once in well 7086. This occurrence of nitrate above the Tier II AL was back in the late 1980s, and all subsequent occurrences were near the detection limit or not detected. The data indicate the OLF is not a source for nitrate contamination of groundwater.

4.5.5 Groundwater Quality Summary

In summary, groundwater quality is not significantly impacted by the OLF. The OLF does not appear to be a source for metal contamination. Uranium concentrations are near background levels even though there appears to be depleted uranium contamination at well 61093, and there may be minor chlorinated solvent contamination arising from the OLF. Furthermore, as shown in Figure 4-25, chlorinated solvent contamination in groundwater does not extend downgradient of the OLF. The most recent VOC data for these wells (last 3 years) indicate chlorinated solvents are either not detected or detected at trace concentrations below 1 μg/L, that is., a chlorinated solvent plume is not emanating from the OLF.

4.6 Surface Water

As detailed in Table 3 of Appendix C, surface water samples were analyzed for metals, radionuclides, VOCs, SVOCs, pesticides, and WQPs. Surface water quality data have been evaluated through comparison to RFETS background levels and surface water ALs, and also through comparison to upgradient conditions. The latter analysis was performed to evaluate local changes in surface water quality in Woman Creek as it passes beside the OLF.

4.6.1 Upgradient Woman Creek Surface Water Quality

As shown in Table 4-4a, several metals, radionuclides, and organic compounds have been detected within Woman Creek with total concentrations above background levels in surface water upgradient of the OLF. The concentrations of some of these constituents were occasionally above the surface water ALs. The highest frequency of concentrations above the surface water ALs was for methylene chloride (approximately 20 percent), followed by lead (approximately 15 percent). The frequencies of concentrations above the surface water ALs were less than 5 percent for the remaining analytes. Methylene chloride is a common laboratory contaminant, and was present in the associated laboratory blank for most of the reported methylene chloride detections. The surface water AL and background value for lead are virtually the same, explaining the occasional concentrations that were above the surface water AL.

As expected, there were fewer dissolved metals and radionuclides with concentrations that exceeded the surface water ALs (Table 4-4b). The frequencies of concentrations above the surface water ALs were less than approximately 5 percent for these analytes.

In summary, there are no significant impacts to Woman Creek water quality upgradient of the OLF.

4.6.2 Downgradient Woman Creek Surface Water Quality

As shown in Tables 4-5a and 4-5b, similar to upgradient Woman Creek water quality, several metals, radionuclides, and organic compounds have been detected above background levels within Woman Creek surface water downgradient of the OLF. The concentrations of many of these analytes were occasionally above the surface water ALs (approximately 5 percent or fewer of the observations), and were generally low in magnitude relative to the surface water ALs. Comparing Tables 4-4a and 4-5a, several metals and organics that were detected above background in surface water downgradient of the OLF have not been detected above background in upgradient surface water. However, these analyte concentrations typically were low relative to the surface water ALs, with only infrequent concentrations above the surface water ALs. If these additional detections can be attributed to the OLF, no analyte exceeded its action level more than 7 percent of the time. This frequency of occurrence is not sufficient to indicate the OLF has a significant chronic impact on surface water quality.

Even though TCE and PCE are present in groundwater at the OLF, the following observations regarding these compounds in Woman Creek surface water are noted to underscore the lack of a chronic impact, if any, from the OLF on Woman Creek water quality:

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- PCE (2 µg/L) and TCE (3 µg/L) were detected at SW033 on April 11, 1990. These compounds were not detected at this station in 10 previous and 19 subsequent sampling events.
- TCE (26 µg/L) was detected at SW032 on November 11, 1987. TCE was not detected at this station in 3 previous and 28 subsequent sampling events.

4.6.3 South Interceptor Ditch Surface Water Quality

As shown in Tables 4-6a and 4-6b, similar to upgradient and downgradient surface water quality in Woman Creek, several metals, radionuclides, and organic compounds have been detected above background levels in the South Interceptor Ditch (SID) surface water. Generally, the concentrations of many of these analytes have been occasionally above the surface water ALs (approximately 5 percent or less of the time), and are low in magnitude relative to the surface water ALs. However, a notable difference between SID surface water quality and Woman Creek surface water quality is evident in the occurrence of barium and the uranium isotopes.

Of the metals, barium has the highest frequency of exceeding background in SID surface water at well over 50 percent of all observations. However, the barium concentrations exceed the surface water AL in only one observation. Table 4-3 indicates barium concentrations are also frequently above background in groundwater. Groundwater infiltration to the SID may be a plausible explanation for the above-background barium concentrations in SID surface water. Barium concentrations in OLF groundwater rarely exceed the Tier II groundwater AL.

Unlike Woman Creek surface water, a relatively high frequency of above-background concentrations for the uranium isotopes (total and dissolved concentrations [Table 4-6a and 4-6b]) exists in the SID, which occur at SW036 only (see Figure 4-4 for station location). The other stations on the SID have low concentrations of uranium (< 5 pCi). Uranium-238, particularly the total concentration (see Table 4-6a), also has frequently exceeded the surface water AL. (The surface water AL is for the sum of the isotopes.) As shown on Figure 4-27, uranium concentrations (sum of the isotopes) at SW036 are typically 30 to 40 pCi/L (total, as opposed to dissolved concentrations), and are rarely below the drainage-specific surface water AL of 11 pCi/l. Also shown on Figure 4-27 are the U-238/U-234 ratios, which are typically about 3. As discussed in Section 4.5 for groundwater, this elevated ratio indicates a depleted uranium component in surface water at this station. As discussed previously, depleted uranium contamination exists in surface soil and in groundwater at well 61093. The depleted uranium contamination at SW036 probably arises from both contaminated runoff and discharge of groundwater to the SID (interflow).

Data presented by K-H (2004) provides perspective on the uranium contamination at SW036. The median concentration of total uranium at SW036 is 30.43 pCi/L. At station SW027, located downstream of SW036 on the SID and upstream of Pond C-2, the median concentration of total uranium is 1.62 pCi/L. At the discharge of Pond C-2, Point of Compliance (POC) GS31, the median concentration is 2.28 pCi/L. These data indicate significant attenuation of the total uranium concentration through settling of particulate uranium and/or by dilution from downstream runoff or groundwater discharge to the SID. The volume of water discharged at SW036 is less than 1 percent of the volume discharged in Woman Creek at Indiana Street. Thus, the uranium load contributed to the Woman Creek watershed by the SW036 watershed is

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relatively small. The median concentration of total uranium at station GS01 (POC for Woman Creek at Indiana Street) is 2.5 pCi/L, well below the surface water AL of 11 pCi/L.

As a final note, even though TCE is present in groundwater at the OLF, the following observation regarding this compound in SID surface water is provided to underscore the lack of a chronic impact:

- TCE (8 µg/L) was detected at SW036 on April 8, 1991. This compound was not detected at this station in 15 previous (except for 1 µg/L on August 8, 1990) and 7 subsequent sampling events.

4.7 Sediment

As detailed in Table 4 of Appendix C, sediments samples were analyzed for metals, radionuclides, VOCs, SVOCs, pesticides, and PCBs. As shown in Table 4-7, only a few metals were detected above background in the sediment of Woman Creek and the South Interceptor Ditch in the vicinity of the OLF. Concentrations were orders of magnitude below the RFCA ALs.

4.8 Contamination Summary and Action Determinations

Contamination of environmental media at the OLF can be summarized as follows:

- Depleted uranium "hot spots" (concentrations above wildlife refuge worker (WRW) ALs) were present in surface soil. The presence of the uranium contamination in surface soil is consistent with the instances of placing depleted uranium on the surface of the OLF. Surface soil removal and confirmation sampling have been conducted at the four uranium isotope "hot spots" in July 2004. A description of the soil removal and confirmation sample results are presented in Appendix E.

- PAH concentrations in surface soil are widespread, some of which exceed the WRW AL. PAH concentrations in subsurface soil are more isolated, some of which also exceed the WRW AL. It appears the source of the contamination is PAH-contaminated runoff from asphalt within the IA, and/or the burial of asphalt and street sweepings in the OLF.

- Groundwater is contaminated with uranium (at one location) and with low concentrations of TCE and PCE (more widespread arising from an upgradient source). There is no definitive contamination of groundwater by metals or other radionuclides and organics. That is, the number of detections above background and the Tier II ALs were very low for these constituents, and their concentrations were also very low relative to background and the Tier II ALs. Well 61093 is the only location where groundwater is contaminated with uranium. It appears the contamination arises from depleted uranium at the surface of the OLF. Surface water in the SID is impacted by this source of contamination from groundwater discharge and/or runoff. Low-level TCE and PCE contamination exists in groundwater at the OLF that appears to emanate from the IA. The OLF may be contributing additional, albeit minor, TCE and PCE contamination to groundwater; however, the groundwater and surface water data indicate this contamination is not

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migrating downgradient of the OLF and is not contaminating surface water. Therefore, the OLF is not a significant source for groundwater contamination.

- Surface water in the SID at SW036 is contaminated with uranium. Otherwise, SID (and Woman Creek) surface water immediately downgradient of the OLF has very low frequencies of analyte concentrations above the surface water ALs, which indicates the OLF does not have a significant chronic impact on these streams. It appears the depleted uranium contamination in the SID arises from the depleted uranium contamination at the surface of the OLF or from the discharge of depleted uranium-contaminated groundwater. However, uranium concentrations quickly attenuate downstream, and the uranium concentrations at the downgradient Woman Creek POCs (GS31 and GS01) are well below the surface water AL.

Given the above observations, the following action determinations have been made for the OLF:

- An action determination in accordance with ALF, Section 5.3 has been made for surface soil with uranium concentrations above the WRW ALs. These "hot spots" have been removed as approved by the CDPHE in July 2004. Appendix E presents the description of the soil removal and confirmation sampling results.

- An action determination in accordance with ALF, Section 4.2 has been made for the PAH-contaminated surface and subsurface soil. The proposed accelerated action of source containment (soil cover) will be conducted in accordance with this IM/IRA (see Section 7.0).

- An action determination in accordance with ALF, Section 3.3 has been made for the uranium and chlorinated solvent groundwater contamination. The uranium-contaminated groundwater may be contributing to surface water AL exceedances at SW036 on the SID; however, it has not caused surface water ALs to be exceeded at the downgradient POCs on Woman Creek despite uncontrolled groundwater discharge from the OLF after the waste disposal operations ceased. There is no indication that PCE and TCE in groundwater at the OLF are migrating downgradient and contaminating surface water. In addition, groundwater fate and transport modeling indicates constituents in the groundwater will not reach Woman Creek above detectable levels. Monitoring (as a part of the accelerated actions) in accordance with the IMP, will evaluate contaminant concentration changes or trends.

4.9 Risk Assessment

As part of the OU 5 Phase I RFI/RI, a baseline human health risk assessment was conducted for Area of Concern 1, which is identical to the OLF area (Kaiser-Hill 1996). Although risk and health effect calculations were made for several receptors and exposure pathways, those most relevant to the future anticipated land used for RFETS are the open space user and the ecological researcher. The total estimated risk for the open space user was calculated as 6E-6 and for the ecological researcher as 1E-6.

An ecological risk assessment was conducted for several RFETS areas, including the Woman Creek Watershed, which is also contained in the OU 5 Phase I RFI/RI Report (Kaiser-Hill 1996).

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The methodology was developed to support risk management decisions for individual Operable Units. The approach used for the assessment is consistent with a screening-level risk assessment appropriate for sites where ecological effects have not been observed, but contaminant levels have been measured and can be compared with concentrations considered protective of ecological receptors.

Relevant to the OLF source area, the evaluated receptor groups and related ecological contaminants of concern (ECOCs) are as follows:

- Aquatic Life – Metals and organics in sediment;
- Aquatic feeding birds – Mercury in fish tissue and antimony in sediment;
- Small mammals- Uranium 233/234 and 238 in soils; and
- Vegetation – Metals in soils and sediments.

In summary, the assessment concluded:

- PAHs were the primary risk to aquatic life; however, no toxicity was detected in sediment toxicity tests using a *Hyalella azteca*.
- Risks from mercury to aquatic feeding birds were significant only if the birds obtained all their food from Pond C-1.
- Risks from antimony to aquatic feeding birds assumed 100 percent site use; however, the streams support a small fish population and risks were not significant if adjusted for realistic site use factors.
- Radionuclides do not present a significant risk to terrestrial receptors.
- The risk to vegetation communities is minimal because of the small source areas and the vegetation growth in contaminated sediment in littoral zones appears normal.

Based on the risk assessment information, baseline risks appear to be well within CERCLA threshold criteria. The presumptive remedy of source containment is expected to maintain or lower the baseline risks.

However, ecological impacts at the OLF will be evaluated by the Accelerated Action Ecological Screening Evaluation (AAESE). The AAESE will be applied to the Upper Woman Drainage Exposure Unit (EU) (DOE 2004, DOE 204a), which includes the OLF, to determine whether an additional accelerated action is required for the EU because of risk to ecological receptors. Because of the large size of the EU relative to the OLF, it is not anticipated the AAESE would indicate adverse ecological effects to the entire EU arising solely from the OLF. Therefore, an impact to the remedy selection for the OLF is also not anticipated.

The OLF will be evaluated as part of the Sitewide Comprehensive Risk Assessment, which is part of the RFI/RI and Corrective Measures Study/Feasibility Study (CMS/FS) that will be

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conducted for the Site. The need for and extent of long-term stewardship activities will be reanalyzed in the RFI/RI and CMS/FS and will be proposed, as appropriate, as part of the preferred alternative in the Proposed Plan for the Site. Institutional controls and other long-term stewardship requirements for Rocky Flats will ultimately be contained in the Corrective Action Decision/Record of Decision (CAD/ROD) and in any post-RFCA agreement.

Table 4-1
Surface Soil Data Summary

Analyte Group	Analyte	Total Number Samples Analyzed	Number of Samples above BG but below the AL	Number of Samples above the AL	Average Conc.	Maximum Conc.	BG Mean Plus 2SD	Wildlife Refuge Worker AL	Unit
Metal	Aluminum	51	2	0	19450	20000	16902	228000	mg/kg
Metal	Antimony	44	2	0	44.8	49.8	0.47	409	mg/kg
Metal	Barium	51	6	0	160	177	141	26400	mg/kg
Metal	Beryllium	51	15	0	1.18	1.7	0.966	921	mg/kg
Metal	Cadmium	45	2	0	3.25	4.1	1.61	962	mg/kg
Metal	Chromium	51	5	0	19.7	24.2	17.0	268	mg/kg
Metal	Cobalt	51	3	0	12.4	13.6	10.9	1550	mg/kg
Metal	Copper	51	20	0	57.8	184	18.1	40900	mg/kg
Metal	Iron	51	3	0	19667	20600	18037	307000	mg/kg
Metal	Lead	51	1	0	129	129	54.6	1000	mg/kg
Metal	Lithium	51	3	0	13.8	15.3	11.6	20400	mg/kg
Metal	Manganese	51	5	0	513	829	365	3480	mg/kg
Metal	Mercury	51	12	0	0.253	0.38	0.134	25200	mg/kg
Metal	Nickel	50	20	0	17.6	26.3	14.9	20400	mg/kg
Metal	Strontium	51	3	0	54.8	62.4	48.9	613000	mg/kg
Metal	Tin	51	2	0	18.9	30.9	2.9	613000	mg/kg
Metal	Zinc	51	10	0	119	199	73.8	307000	mg/kg
PCB	Aroclor-1254	51	12	0	1481	3900	-	12400	ug/kg
Pesticide	4,4'-DDT	51	1	0	21	21	-	100000	ug/kg
Pesticide	Dieldrin	51	1	0	34	34	-	1720	ug/kg
Pesticide	Endosulfan sulfate	51	1	0	24	24	-	4420000	ug/kg
Radionuclide	Americium-241	57	9	0	0.0447	0.0865	0.0227	76	pCi/g
Radionuclide	Plutonium-239/240	58	11	0	0.144	0.338	0.066	50	pCi/g
Radionuclide	Uranium-234	59	11	1	293	2800	2.25	300	pCi/g
Radionuclide	Uranium-235	59	9	4	84.5	670	0.0939	8	pCi/g
Radionuclide	Uranium-238	59	16	4	2620	38000	2	351	pCi/g
SVOC	2-Methylnaphthalene	48	2	0	6395	12000	-	20400000	ug/kg
SVOC	Acenaphthene	49	2	0	23300	44000	-	40800000	ug/kg
SVOC	Anthracene	49	3	0	16903	47000	-	204000000	ug/kg
SVOC	Benzo(a)anthracene	48	8	1	7215	45000	-	34900	ug/kg
SVOC	Benzo(a)pyrene	49	8	2	6765	43000	-	3490	ug/kg
SVOC	Benzo(b)fluoranthene	49	10	1	6677	49000	-	34900	ug/kg
SVOC	Benzo(k)fluoranthene	49	7	0	4008	25000	-	349000	ug/kg

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Analyte Group	Analyte	Total Number Samples Analyzed	Number of Samples above BG but below the AL	Number of Samples above the AL	Average Conc.	Maximum Conc.	BG Mean Plus 2SD	Wildlife Refuge Worker AL	Unit
SVOC	Chrysene	48	8	0	7461	46000	-	3490000	ug/kg
SVOC	Dibenz(a,h)anthracene	36	2	1	5150	9200	-	3490	ug/kg
SVOC	Dibenzofuran	49	2	0	10650	20000	-	2950000	ug/kg
SVOC	Fluoranthene	49	14	0	12551	140000	-	27200000	ug/kg
SVOC	Fluorene	49	2	0	20650	39000	-	40800000	ug/kg
SVOC	Indeno(1,2,3-cd)pyrene	38	3	0	12067	32000	-	34900	ug/kg
SVOC	Pyrene	49	14	0	10767	120000	-	22100000	ug/kg
VOC	Naphthalene	49	2	0	22000	41000	-	3090000	ug/kg
	Above the Wildlife Refuge Worker Action Level								

Note: Analytes shown are those that were detected at least once above background levels and have a Wildlife Refuge Worker Action Level. The maximum concentration is the maximum detected value, and the average concentration is the average of the data that exceed background.
BG – Background
AL - Action Level

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Table 4-2
Subsurface Soil Data Summary

Analyte Group	Analyte	Total Number Samples Analyzed	Number of Samples above BG but below the AL	Number of Samples above the AL	Average Conc.	Maximum Conc.	BG Mean Plus 2SD	Wildlife Refuge Worker AL	Unit
Metal	Antimony	51	1	0	19.5	19.5	16.97	409	mg/kg
Metal	Arsenic	62	1	0	18.9	18.9	13.14	22.2	mg/kg
Metal	Barium	62	1	0	387	387	289.38	26400	mg/kg
Metal	Cadmium	61	1	0	2.3	2.3	1.7	962	mg/kg
Metal	Chromium	62	3	0	118	165	68.27	268	mg/kg
Metal	Copper	62	11	0	779	6920	38.21	40900	mg/kg
Metal	Iron	62	2	0	64200	78900	41047	307000	mg/kg
Metal	Lead	62	12	0	105	304	24.97	1000	mg/kg
Metal	Manganese	62	3	0	1273	1540	902	3480	mg/kg
Metal	Molybdenum	60	1	0	190	190	25.61	5110	mg/kg
Metal	Nickel	62	6	0	93.6	118	62.21	20400	mg/kg
Metal	Silver	60	1	0	36	36	24.54	5110	mg/kg
Metal	Zinc	62	10	0	342	673	139.1	307000	mg/kg
PCB	Aroclor-1254	53	7	0	694	960		12400	ug/kg
PCB	Aroclor-1260	54	3	0	887	1300		12400	ug/kg
Radionuclide	Americium-241	60	7	0	0.117	0.46	0.02	76	pCi/g
Radionuclide	Plutonium-239/240	62	18	0	0.340	3.2	0.02	50	pCi/g
Radionuclide	Uranium-234	62	4	0	13.0	30	2.64	300	pCi/g
Radionuclide	Uranium-235	62	6	0	0.606	2.3	0.12	8	pCi/g
Radionuclide	Uranium-238	62	20	0	2.69	12	1.49	351	pCi/g
SVOC	2-Methylnaphthalene	54	1	0	15000	15000		20400000	ug/kg
SVOC	Acenaphthene	54	5	0	6936	31000		40800000	ug/kg
SVOC	Anthracene	54	9	0	6143	46000		204000000	ug/kg
SVOC	Benzo(a)anthracene	54	9	1	6918	48000		34900	ug/kg
SVOC	Benzo(a)pyrene	54	9	2	6243	43000		3490	ug/kg
SVOC	Benzo(b)fluoranthene	54	10	1	6431	48000		34900	ug/kg
SVOC	Benzo(k)fluoranthene	54	10	0	2545	19000		349000	ug/kg
SVOC	Butylbenzylphthalate	54	2	0	1400	1400		147000000	ug/kg
SVOC	Chrysene	54	9	0	7412	53000		3490000	ug/kg
SVOC	Dibenz(a,h)anthracene	54	1	0	700	700		3490	ug/kg
SVOC	Dibenzofuran	54	1	0	20000	20000		2950000	ug/kg
SVOC	Fluoranthene	54	13	0	15145	160000		27200000	ug/kg
SVOC	Fluorene	54	5	0	7802	35000		40800000	ug/kg
SVOC	Indeno(1,2,3-cd)pyrene	54	9	0	3369	22000		34900	ug/kg
SVOC	Pyrene	54	12	0	14952	150000		22100000	ug/kg
VOC	Acetone	126	2	0	265	280		102000000	ug/kg
VOC	Chloroform	128	1	0	19	19		19200	ug/kg
VOC	Ethylbenzene	128	1	0	66	66		4250000	ug/kg
VOC	Methylene chloride	128	2	0	82	150		2530000	ug/kg

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Analyte Group	Analyte	Total Number Samples Analyzed	Number of Samples above BG but below the AL	Number of Samples above the AL	Average Conc.	Maximum Conc.	BG Mean Plus 2SD	Wildlife Refuge Worker AL	Unit
VOC	Naphthalene	54	5	0	12914	61000		3090000	ug/kg
VOC	Tetrachloroethene	128	14	0	256	900		615000	ug/kg
VOC	Toluene	126	37	0	40	220		31300000	ug/kg
VOC	Trichloroethene	128	10	0	97.8	390		19600	ug/kg
VOC	Xylene	128	1	0	150	150		2040000	ug/kg
	Above the Wildlife Refuge Worker Action Level								

Note: Analytes shown are those that were detected at least once above background levels and have a Wildlife Refuge Worker Action Level. The maximum concentration is the maximum detected value, and the average concentration is the average of the data that exceed background.
BG – Background
AL - Action Level

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Table 4-3
Groundwater Data Summary

Analyte Group	Analyte	Total Number Samples Analyzed	Number of Samples above BG but below the Tier II AL[1]	Number of Samples above Tier II AL but below the Tier I AL	Number of Samples above Tier I AL	Average Conc.	Maximum Conc.	BG Mean Plus 2SD	Tier II AL	Tier I AL	Unit
Metal	Aluminum	201	9	0	0	2.21	4.9	0.234	36.5	3650	mg/L
Metal	Antimony*	200	6	3	0	0.0631	0.0719	0.03954	0.006	0.6	mg/L
Metal	Arsenic	202	12	0	0	0.0101	0.0197	0.00531	0.05	5	mg/L
Metal	Barium	210	67	0	0	0.241	0.647	0.153	2	200	mg/L
Metal	Beryllium	202	0	2	0	0.00615	0.007	0.00267	0.004	0.4	mg/L
Metal	Cadmium	203	1	2	0	0.0054	0.0064	0.00425	0.005	0.5	mg/L
Metal	Chromium	209	1	0	0	0.018	0.018	0.0124	0.1	10	mg/L
Metal	Copper	201	15	0	0	0.0198	0.0317	0.0139	1.3	130	mg/L
Metal	Lead	203	1	1	0	0.0505	0.087	0.0110	0.015	1.5	mg/L
Metal	Lithium	197	2	0	0	0.157	0.166	0.143	0.73	73	mg/L
Metal	Manganese	204	63	15	0	1.02	10.5	0.162	1.72	172	mg/L
Metal	Mercury	196	4	0	0	0.00044	0.0006	0.00025	0.002	0.2	mg/L
Metal	Nickel	210	24	13	0	0.152	0.654	0.0214	0.14	14	mg/L
Metal	Selenium	208	0	24	0	0.521	1.02	0.0437	0.05	5	mg/L
Metal	Silver	202	5	0	0	0.01076	0.0122	0.00708	0.183	18.3	mg/L
Metal	Strontium	201	19	0	0	1.28	1.97	0.931	21.9	2190	mg/L
Metal	Thallium	199	9	12	0	0.00645	0.0083	0.0049	0.002	0.2	mg/L
Metal	Zinc	202	5	0	0	0.294	1.03	0.0498	11	1100	mg/L
Pesticide	Dieldrin	29	0	4	0	0.183	0.24	-	0.00532	0.532	µg/L
Radionuclide	Americium-241	26	0	1	0	0.74	0.74	0.03	0.145	14.5	pCi/L
Radionuclide	Plutonium-239/240	27	2	0	0	0.022	0.033	0.01	0.151	15.1	pCi/L
Radionuclide	Radium-226	50	13	0	0	0.74	1.2	0.48	20	2000	pCi/L
Radionuclide	Strontium-90*	111	8	8	0	1.64	3.4	0.96	0.852	85.2	pCi/L

Analyte Group	Analyte	Total Number Samples Analyzed	Number of Samples above BG but below the Tier II AL[1]	Number of Samples above Tier II AL but below the Tier I AL	Number of Samples above Tier I AL	Average Conc.	Maximum Conc.	BG Mean Plus 2SD	Tier II AL	Tier I AL	Unit
Radionuclide	Uranium-235*	188	4	1	0	1.55	1.547	1.48	1.01	101	pCi/L
Radionuclide	Uranium-238*	188	129	0	1	80.83	80.83	40.2	0.768	76.8	pCi/L
SVOC	2,4-Dimethylphenol	80	1	0	0	2	2	-	730	73000	µg/L
SVOC	2-Methylphenol	80	1	0	0	1	1	-	1830	183000	µg/L
SVOC	4-Methylphenol	80	2	0	0	6.5	10	-	183	18300	µg/L
SVOC	Acenaphthene	81	10	0	0	3.1	5	-	2190	219000	µg/L
SVOC	Anthracene	81	1	0	0	0.5	0.5	-	11000	1100000	µg/L
SVOC	bis(2-Ethylhexyl)phthalate	80	33	4	0	12.65	150	-	6	600	µg/L
SVOC	Butylbenzylphthalate	80	6	0	0	1.83	3	-	7300	730000	µg/L
SVOC	Di-n-butylphthalate	80	1	0	0	2.00	2	-	3650	365000	µg/L
SVOC	Di-n-octylphthalate	81	13	0	0	2.48	6	-	730	73000	µg/L
SVOC	Dibenzofuran	80	22	0	0	1.82	3	-	146	14600	µg/L
SVOC	Diethylphthalate	80	5	0	0	6.40	14	-	29200	2920000	µg/L
SVOC	Fluoranthene	81	9	0	0	1.89	4	-	1460	146000	µg/L
SVOC	Fluorene	81	8	0	0	2.38	4	-	1460	146000	µg/L
SVOC	Pyrene	81	8	0	0	1.60	3	-	100	110000	µg/L
VOC	1,1,1-Trichloroethane	300	22	0	0	2.76	37	-	200	20000	µg/L
VOC	1,1,2,2-Tetrachloroethane	296	0	1	0	3.00	3	-	0.426	42.6	µg/L
VOC	1,1,2-Trichloroethane	300	1	0	0	2.00	2	-	5	500	µg/L
VOC	1,1-Dichloroethane	296	9	0	0	0.95	3	-	3650	365000	µg/L
VOC	1,1-Dichloroethene	300	52	1	0	1.61	31	-	7	700	µg/L
VOC	1,2,4-Trichlorobenzene	261	1	0	0	0.70	0.7	-	70	7000	µg/L
VOC	1,2-Dichloroethene (total)	118	8	0	0	2.88	4	-	70	7000	µg/L
VOC	1,4-Dichlorobenzene	261	1	0	0	0.40	0.4	-	75	7500	µg/L

Analyte Group	Analyte	Total Number Samples Analyzed	Number of Samples above BG but below the Tier II AL[1]	Number of Samples above Tier II AL but below the Tier I AL	Number of Samples above Tier I AL	Average Conc.	Maximum Conc.	BG Mean Plus 2SD	Tier II AL	Tier I AL	Unit
VOC	4-Methyl-2-pentanone	190	1	0	0	2.00	2	-	2920	292000	µg/L
VOC	Acetone	172	26	0	0	17.09	65	-	3650	365000	µg/L
VOC	Benzene	296	3	0	0	0.47	1	-	5	500	µg/L
VOC	Carbon Disulfide	190	3	0	0	0.70	1	-	3650	365000	µg/L
VOC	Carbon Tetrachloride	300	7	0	0	1.11	2.5	-	5	500	µg/L
VOC	Chloroform	299	15	0	0	0.30	0.74	-	100	10000	µg/L
VOC	Hexachlorobutadiene	261	2	0	0	0.10	0.1	-	1.09	109	µg/L
VOC	Methylene chloride	298	50	7	0	2.62	23	-	5	500	µg/L
VOC	Naphthalene	262	12	0	0	4.26	16	-	1460	146000	µg/L
VOC	Tetrachloroethene	301	76	15	0	6.78	110	-	5	500	µg/L
VOC	Toluene	296	7	0	0	0.60	2	-	1000	100000	µg/L
VOC	Trichloroethene	301	82	16	0	5.68	140	-	5	500	µg/L
VOC	Xylene	275	2	0	0	0.79	1	-	10000	1000000	µg/L
	Above the Tier II Groundwater Action Level										

Note: Analytes shown are those that were detected at least once above background levels and have a Groundwater Action Level. The maximum concentration is the maximum detected value, and the average concentration is the average of the data that exceed background. Metals and radionuclides are dissolved concentrations. Organics are total concentrations.
*Background exceeds the AL.
BG – Background
AL - Action Level
[1] This column includes the number of samples exceeding the Tier II AL but less than BG when the BG value for an analyte exceeds the Tier II AL.

Table 4-4a
Upgradient Woman Creek Surface Water Data Summary (Total Concentrations)

Analyte Group	Analyte	Total Number Samples Analyzed	Number of Samples above BG but below the AL[1]	Number of Samples above AL	Average Conc.	Maximum Conc.	BG Mean Plus 2SD	Surface Water AL	Unit
Metal	Aluminum*	51	23	3	5.08	5.52	3.45	0.087	mg/L
Metal	Barium	52	2	0	0.136	0.136	0.12688	0.49	mg/L
Metal	Beryllium	46	0	1	0.0084	0.0084	0.00234	0.004	mg/L
Metal	Lead*	52	0	8	0.01	0.016	0.00658	0.0065	mg/L
Metal	Mercury*	49	4	1	0.0011	0.0011	0.00041	0.00001	mg/L
Metal	Nickel	49	1	0	0.0359	0.0359	0.01987	0.123	mg/L
Metal	Silver*	52	6	1	0.0079	0.0079	0.00591	0.0006	mg/L
Radionuclide	Americium-241	43	5	2	0.0809	0.162	0.02	0.15	pCi/L
Radionuclide	Plutonium-239/240	43	4	0	0.0653	0.146	0.02	0.15	pCi/L
Radionuclide	Tritium	44	0	2	1580	2170	494	500	pCi/L
Radionuclide	Uranium-234**	35	1	1	6.61	11.5	1.59	10	pCi/L
Radionuclide	Uranium-235**	34	3	0	0.35	0.43	0.19	10	pCi/L
Radionuclide	Uranium-238**	35	4	0	2.07	2.81	1.22	10	pCi/L
SVOC	Diethylphthalate	12	1	0	2	2	-	5600	µg/L
VOC	1,2-Dichloroethane	50	0	1	11	11	-	0.38	µg/L
VOC	2-Butanone	44	1	0	12	12	-	21900	µg/L
VOC	4-Methyl-2-pentanone	46	1	0	31	31	-	2920	µg/L
VOC	Acetone	47	16	0	9.75	23	-	3650	µg/L
VOC	Carbon Disulfide	46	1	0	6	6	-	3650	µg/L
VOC	Carbon Tetrachloride	50	0	1	6	6	-	0.25	µg/L
VOC	Chloroform	50	1	0	3	3	-	5.7	µg/L
VOC	Methylene chloride	49	12	9	6.95	29	-	4.7	µg/L
VOC	Tetrachloroethene	50	0	1	10	10	-	0.8	µg/L
VOC	Toluene	48	2	0	10.5	12	-	1000	µg/L
VOC	Trichloroethene	50	0	1	8	8	-	2.7	µg/L
	Above the Surface Water Action Level								

Note: Data are for surface water stations SW039, SW040, SW041, and SW506. Analytes shown are those that were detected at least once above background levels and have a Surface Water Action Level. The maximum concentration is the maximum detected value, and the average concentration is the average of the data that exceed background.
*Background exceeds the AL.
** The uranium surface water AL is for total uranium (sum of the isotopes).
BG – Background
AL - Action Level
[1] This column includes the number of samples exceeding the AL but less than BG when the BG value for an analyte exceeds the AL.

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Table 4-4b
Upgradient Woman Creek Surface Water Data Summary (Dissolved Concentrations)

Analyte Group	Analyte	Total Number Samples Analyzed	Number of Samples above BG but below the AL[1]	Number of Samples above the AL	Average Conc.	Maximum Conc.	BG Mean Plus 2SD	Surface Water AL	Unit
Metal	Aluminum*	49	2	2	1.57	2.5	0.421	0.087	mg/L
Metal	Copper	56	1	1	0.022	0.028	0.0158	0.016	mg/L
Metal	Lead	52	0	3	0.0073	0.008	0.00459	0.0065	mg/L
Metal	Mercury*	51	0	2	0.000385	0.00044	0.00026	0.00001	mg/L
Metal	Zinc	54	4	0	0.0693	0.0757	0.0499	0.141	mg/L
Radionuclide	Uranium-234**	21	1	0	2.28	2.28	1.08	10	pCi/L
Radionuclide	Uranium-238**	21	1	0	1.44	1.44	0.82	10	pCi/L
	Above the Surface Water Action Level								

Note: Data are for surface water stations SW039, SW040, SW041, and SW506. Analytes shown are those that were detected at least once above background levels and have a Surface Water Action Level. The maximum concentration is the maximum detected value, and the average concentration is the average of the data that exceed background.
*Background exceeds the AL.
** The uranium surface water AL is for total uranium (sum of the isotopes).
BG – Background
AL - Action Level
[1] This column includes the number of samples exceeding the AL but less than BG when the BG value for an analyte exceeds the AL.

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Table 4-5a
Downgradient Woman Creek Surface Water Data Summary
(Total Concentrations)

Analyte Group	Analyte	Total Number Samples Analyzed	Number of Samples above BG but below the AL[1]	Number of Samples above the AL	Average Conc.	Maximum Conc.	BG Mean Plus 2SD	Surface Water AL	Unit
Metal	Aluminum*	61	25	1	24.8	24.8	3.45	0.087	mg/L
Metal	Antimony*	58	2	2	0.0502	0.0559	0.0350	0.006	mg/L
Metal	Barium	63	1	0	0.238	0.238	0.127	0.49	mg/L
Metal	Beryllium	61	0	1	0.0044	0.0044	0.00234	0.004	mg/L
Metal	Cadmium*	57	1	1	0.0068	0.0068	0.00393	0.0015	mg/L
Metal	Copper	60	0	2	0.04305	0.0609	0.0153	0.016	mg/L
Metal	Lead*	59	0	2	0.0215	0.0248	0.00658	0.0065	mg/L
Metal	Selenium*	59	0	5	0.0118	0.02	0.00565	0.0046	mg/L
Metal	Silver*	61	5	1	0.07	0.07	0.00591	0.0006	mg/L
Metal	Zinc*	63	1	1	0.312	0.312	0.155	0.141	mg/L
Pesticide	Toxaphene	19	0	1	1	1	-	0.0002	µg/L
Radionuclide	Americium-241	59	5	4	0.112	0.38	0.02	0.15	pCi/L
Radionuclide	Plutonium-239/240	61	8	2	0.103	0.26	0.02	0.15	pCi/L
Radionuclide	Uranium-234**	43	3	0	2.41	2.9	1.59	10	pCi/L
Radionuclide	Uranium-235**	40	3	0	0.447	0.74	0.19	10	pCi/L
Radionuclide	Uranium-238**	43	2	0	1.81	2.06	1.22	10	pCi/L
SVOC	n-Nitrosodiphenylamine	19	2	0	3	5	-	5	µg/L
VOC	1,1-Dichloroethane	66	1	0	3	3	-	3650	µg/L
VOC	1,1-Dichloroethene	68	1	0	5	5	-	7	µg/L
VOC	1,2-Dichloroethane	68	0	2	8.5	14	-	0.38	µg/L
VOC	1,2-Dichloropropane	66	0	1	3	3	-	0.52	µg/L
VOC	Acetone	56	7	0	12.1	57	-	3650	µg/L
VOC	Carbon Disulfide	64	1	0	1	1	-	3650	µg/L
VOC	Carbon Tetrachloride	67	0	1	6	6	-	0.25	µg/L
VOC	Ethylbenzene	66	1	0	1	1	-	700	µg/L
VOC	Methylene chloride	66	10	6	5.78	26	-	4.7	µg/L
VOC	Styrene	66	1	0	1	1	-	100	µg/L
VOC	Tetrachloroethene	68	0	1	2	2	-	0.8	µg/L
VOC	Toluene	66	2	0	7	12	-	1000	µg/L
VOC	Trichloroethene	68	0	2	14.5	26	-	2.7	µg/L
VOC	Xylene	77	2	0	2	3	-	10000	µg/L
	Above the Surface Water Action Level								

Note: Data are for surface water stations SW032, SW033, SW10295, SW50193, and SW50293. Analytes shown are those that were detected at least once above background levels and have a Surface Water Action Level. The maximum concentration is the maximum detected value, and the average concentration is the average of the data that exceed background.
*Background exceeds the AL.
** The uranium surface water AL is for total uranium (sum of the isotopes).
BG – Background
AL - Action Level
[1] This column includes the number of samples exceeding the AL but less than BG when the BG value for an analyte exceeds the AL.

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Table 4-5b
Downgradient Woman Creek Surface Water Data Summary
(Dissolved Concentrations)

Analyte Group	Analyte	Total Number Samples Analyzed	Number of Samples above BG but below the AL[1]	Number of Samples above the AL	Average Conc.	Maximum Conc.	BG Mean Plus 2SD	Surface Water AL	Unit
Metal	Aluminum*	63	3	1	0.583	0.583	0.421	0.087	mg/L
Metal	Barium	65	1	0	0.123	0.123	0.116	0.49	mg/L
Metal	Beryllium*	57	0	1	0.09	0.09	0.00504	0.004	mg/L
Metal	Cadmium*	61	0	2	0.00505	0.0051	0.00308	0.0015	mg/L
Metal	Copper	59	0	2	0.0315	0.04	0.01584	0.016	mg/L
Metal	Mercury*	57	4	3	0.000353	0.00047	0.00026	0.00001	mg/L
Metal	Selenium*	63	1	3	0.0127	0.015	0.0095	0.0046	mg/L
Metal	Silver*	63	8	1	0.0103	0.0103	0.00816	0.0006	mg/L
Metal	Zinc	66	6	0	0.0612	0.074	0.0499	0.141	mg/L
Radionuclide	Americium-241	12	0	1	0.44	0.44	0.33	0.15	pCi/L
Radionuclide	Uranium-234**	31	5	0	3.00	5.72	1.08	10	pCi/L
Radionuclide	Uranium-238**	32	6	0	2.04	4.81	0.82	10	pCi/L
	Above the Surface Water Action Level								

Note: Data are for surface water stations SW032, SW033, SW10295, SW50193, and SW50293. Analytes shown are those that were detected at least once above background levels and have a Surface Water Action Level. The maximum concentration is the maximum detected value, and the average concentration is the average of the data that exceed background.
*Background exceeds the AL.
** The uranium surface water AL is for total uranium (sum of the isotopes).
BG – Background
AL - Action Level
[1] This column includes the number of samples exceeding the AL but less than BG when the BG value for an analyte exceeds the AL.

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Table 4-6a
South Interceptor Ditch Surface Water Data Summary (Total Concentrations)

Analyte Group	Analyte	Total Number Samples Analyzed	Number of Samples above BG but below the AL[1]	Number of Samples above the AL	Average Conc.	Maximum Conc.	BG Mean Plus 2SD	Surface Water AL	Unit
Metal	Aluminum*	81	39	4	32.636	99.6	3.45	0.087	mg/L
Metal	Arsenic*	79	16	3	0.00727	0.0094	0.00525	0.000018	mg/L
Metal	Barium	81	60	1	0.189	1.47	0.127	0.49	mg/L
Metal	Beryllium	79	0	1	0.00780	0.0078	0.00234	0.004	mg/L
Metal	Cadmium*	77	2	1	0.00900	0.009	0.00393	0.0015	mg/L
Metal	Copper	80	0	2	0.075	0.122	0.0153	0.016	mg/L
Metal	Lead*	81	0	4	0.045	0.084	0.00658	0.0065	mg/L
Metal	Mercury*	74	6	1	0.00053	0.00053	0.00041	0.00001	mg/L
Metal	Nickel	75	3	0	0.059	0.105	0.0199	0.123	mg/L
Metal	Selenium*	79	0	1	0.020	0.02	0.00565	0.0046	mg/L
Metal	Silver*	80	5	6	0.009	0.0133	0.00591	0.0006	mg/L
Metal	Zinc*	79	1	2	0.431	0.448	0.155	0.141	mg/L
Radionuclide	Americium-241	53	5	2	0.204	0.936	0.02	0.15	pCi/L
Radionuclide	Plutonium-239/240	68	5	2	0.172	0.612	0.02	0.15	pCi/L
Radionuclide	Tritium	47	0	3	1563	2990	494	500	pCi/L
Radionuclide	Uranium-234**	54	45	2	5.27	13.77	1.59	10	pCi/L
Radionuclide	Uranium-235**	52	26	0	0.426	1.03	0.19	10	pCi/L
Radionuclide	Uranium-238**	54	11	30	16.9	74	1.22	10	pCi/L
SVOC	bis(2-Ethylhexyl)phthalate	23	1	2	2	3	-	1.8	µg/L
SVOC	Diethylphthalate	23	1	0	4	4	-	5600	µg/L
SVOC	n-Nitrosodiphenylamine	23	1	0	4	4	-	5	µg/L
VOC	2-Butanone	51	2	0	7.5	12	-	21900	µg/L
VOC	Acetone	52	5	0	49.54	210	-	3650	µg/L
VOC	Bromoform	59	1	0	1.9	1.9		4.3	
VOC	Chloroform	59	4	0	2.36	4	-	5.7	µg/L
VOC	Methylene chloride	59	10	3	3.08	7	-	4.7	µg/L
VOC	Toluene	59	2	0	2	3	-	1000	µg/L
VOC	Trichloroethene	59	1	1	4.5	8	-	2.7	µg/L
	Above the Surface Water Action Level								

Note: Data are for surface water stations INT. DITCH, SW036, SW038, SW129, and SW500. Analytes shown are those that were detected at least once above background levels and have a Surface Water Action Level. The maximum concentration is the maximum detected value, and the average concentration is the average of the data that exceed background.
*Background exceeds the AL.
** The uranium surface water AL is for total uranium (sum of the isotopes).
BG – Background
AL - Action Level
[1] This column includes the number of samples exceeding the AL but less than BG when the BG value for an analyte exceeds the AL.

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Table 4-6b
South Interceptor Ditch Surface Water Data Summary
(Dissolved Concentrations)

Analyte Group	Analyte	Total Number Samples Analyzed	Number of Samples above BG but below the AL[1]	Number of Samples above the AL	Average Conc.	Maximum Conc.	BG Mean Plus 2SD	Surface Water AL	Unit
Metal	Aluminum*	51	3	1	46.9	46.9	0.421	0.087	mg/L
Metal	Arsenic*	47	7	2	0.0045	0.005	0.00382	0.000018	mg/L
Metal	Barium	53	36	0	0.145	0.178	0.116	0.49	mg/L
Metal	Beryllium*	53	1	1	0.09	0.09	0.00504	0.004	mg/L
Metal	Cadmium*	47	1	2	0.0042	0.0048	0.00308	0.0015	mg/L
Metal	Copper	51	0	1	0.101	0.101	0.0158	0.016	mg/L
Metal	Lead	52	1	2	0.0327	0.072	0.00459	0.0065	mg/L
Metal	Mercury*	48	1	3	0.0007	0.001	0.00026	0.00001	mg/L
Metal	Nickel	51	1	0	0.063	0.063	0.0186	0.123	mg/L
Metal	Zinc	51	3	2	0.298	1	0.0499	0.141	mg/L
Radionuclide	Uranium-234**	26	20	1	3.18	11.8	1.08	10	pCi/L
Radionuclide	Uranium-238**	26	15	4	7.47	25.9	0.82	10	pCi/L

	Above the Surface Water Action Level

Note: Data are for surface water stations INT. DITCH, SW036, SW038, SW129, and SW500. Analytes shown are those that were detected at least once above background levels and have a Surface Water Action Level. The maximum concentration is the maximum detected value, and the average concentration is the average of the data that exceed background.
*Background exceeds the AL.
** The uranium surface water AL is for total uranium (sum of the isotopes).
BG – Background
AL - Action Level
[1] This column includes the number of samples exceeding the AL but less than BG when the BG value for an analyte exceeds the AL.

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Table 4-7
Sediment Data Summary

Analyte	Total Number Samples Analyzed	Number of Samples above BG but below the AL	Number of Samples above the AL	Average Conc.	Maximum Conc.	Bkg Mean Plus 2SD	Wildlife Refuge Worker AL	Unit
Aluminum	4	1	0	17400	17400	15713	228000	mg/kg
Antimony	3	1	0	36.5	36.5	13.01	409	mg/kg
Cadmium	4	1	0	2.8	2.8	1.88	962	mg/kg
Copper	4	1	0	125	125	27.3	40900	mg/kg
Mercury	4	1	0	3.8	3.8	0.34	25200	mg/kg
Nickel	4	1	0	21.3	21.3	17.9	20400	mg/kg
Silver	4	1	0	7.7	7.7	2.28	5110	mg/kg
Zinc	4	2	0	513.5	681	104	307000	mg/kg
	Above the Wildlife Refuge Worker Action Level							

Note: Analytes shown are those that were detected at least once above background levels and have a Wildlife Refuge Worker Action Level. The maximum concentration is the maximum detected value, and the average concentration is the average of the data that exceed background.
BG – Background
AL - Action Level

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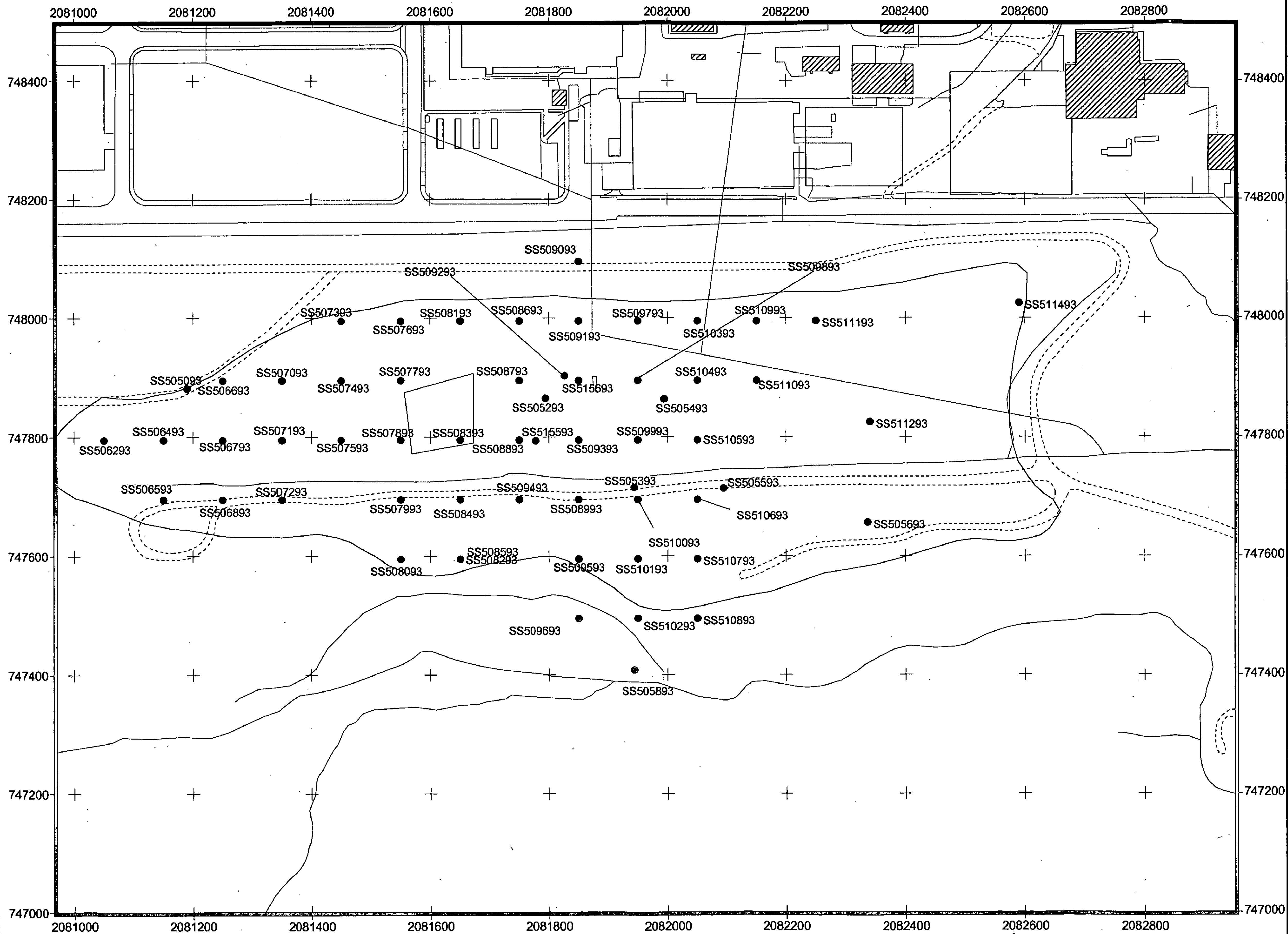
Figure 4-1
Surface Soil
Sampling Locations



• Surface Soil Sampling Location
IHSS
Paved road
Dirt road
Stream
Demolished building
Standing building

N
W E
S

150 0 150 Feet

Scale = 1: 2000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by: Date: June 2004

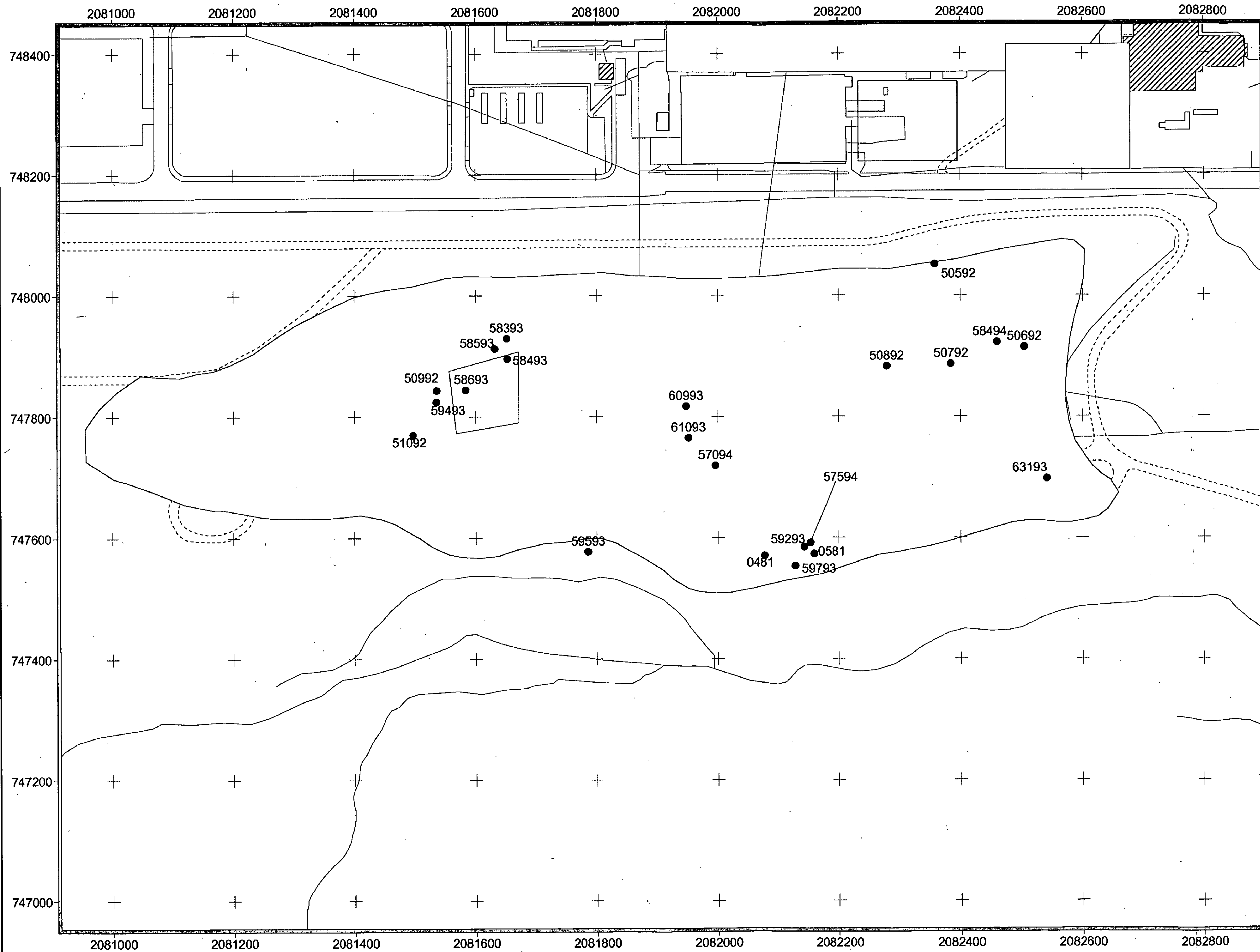
RADMS

Prepared for:

KAISER•HILL COMPANY

File: W:\Projects\Fy2003\SW-2\Remediation\olf_max_concs-061704.apr

Figure 4-2
Subsurface Soil Sampling Locations



Subsurface Soil Sampling Location

IHSS

Paved road

Dirt road

Stream

Demolished building

Standing building

N W E S

150 0 150 Feet

Scale = 1: 2000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by: Date: June 2004

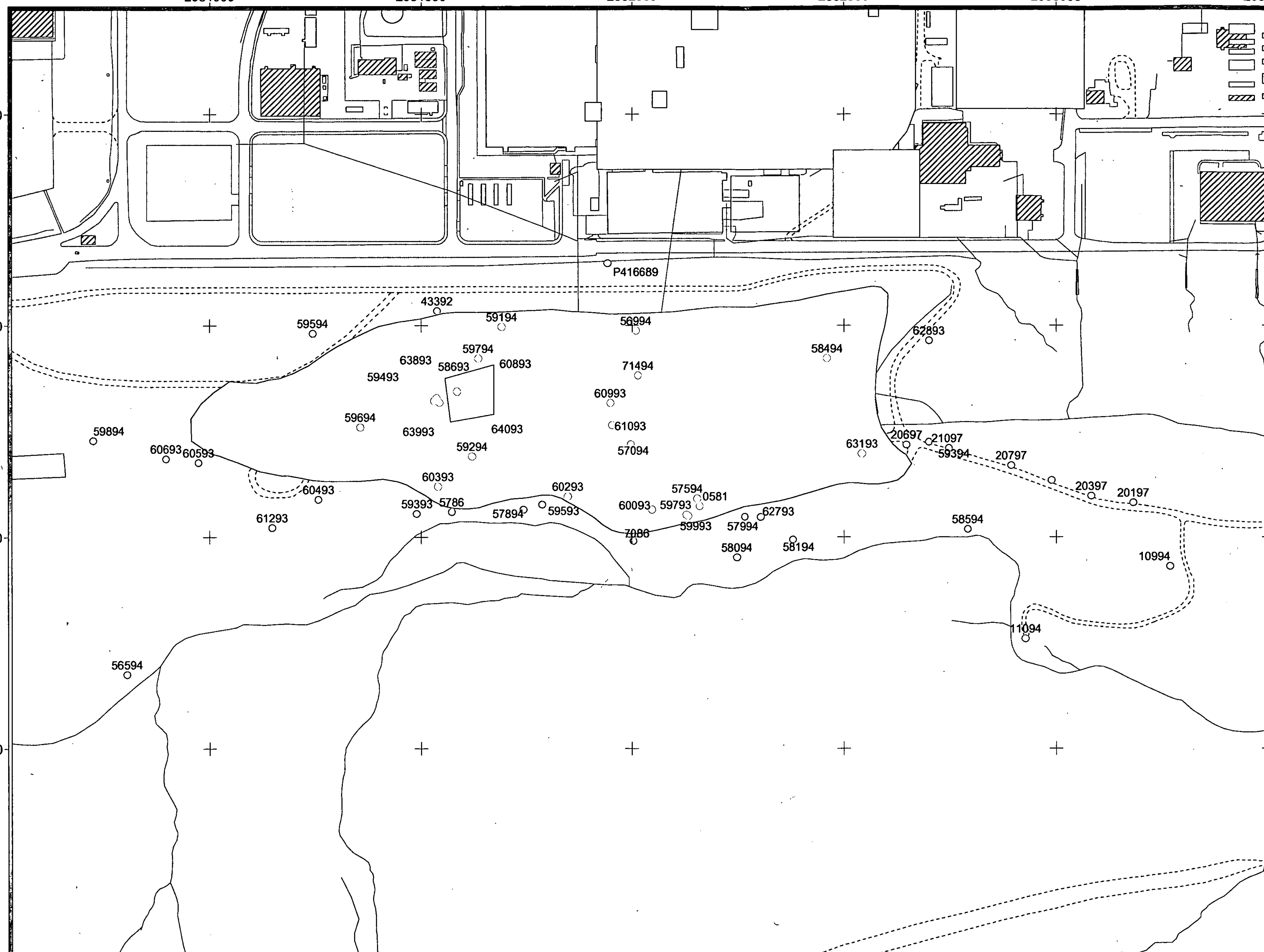
RADMS

Prepared for:

KAISER•HILL COMPANY

File: W:\Projects\Fy2003\SW-2\Remediation\olf_max_concs-061704.apr

Figure 4-3
Groundwater Sampling Locations



KEY

- Groundwater Sampling Locations
- IHSS
- Paved road
- Dirt road
- Streams
- Demolished building
- Standing building

N
W E
S

200 0 200 Feet

Scale = 1: 3000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

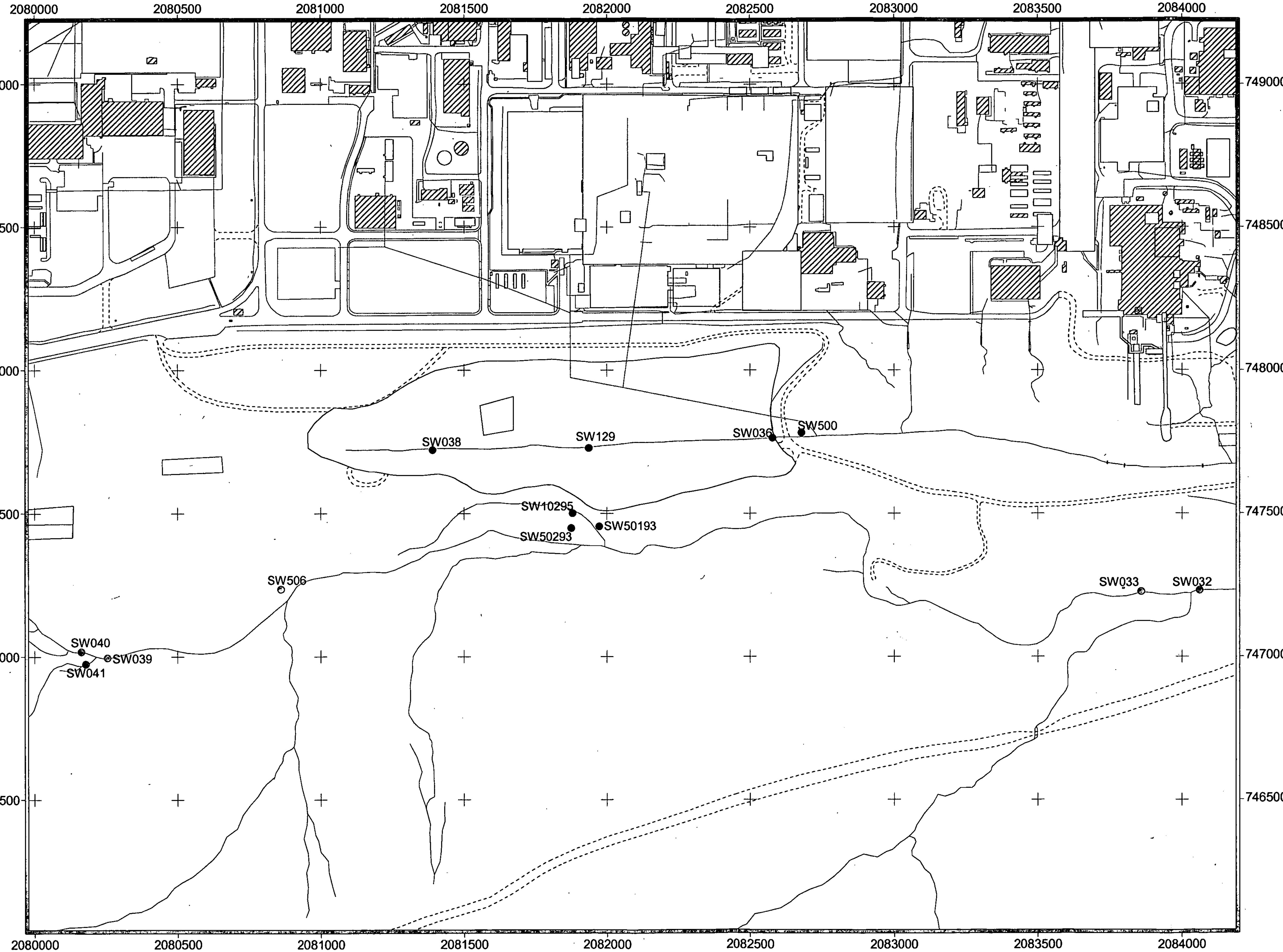
Date: 7.19.04

Prepared by: RADMS

Prepared for: KAISER+HILL COMPANY

File: W:\Projects\Fy2003\SW-2\Remediation\olf_max_concs-061704.apr

Figure 4-4
Surface Water Sampling Locations



KEY

- Surface Water Sampling Location
- IHSS
- Paved road
- Dirt road
- Stream
- Demolished building
- Standing building

N W E S

300 0 300 Feet

Scale = 1: 4250

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by: Date: June 2004

RADMS

Prepared for:

KAISER•HILL COMPANY

File: W:\Projects\Fy2003\SW-2\Remediation\olf_max_concs-061704.apr

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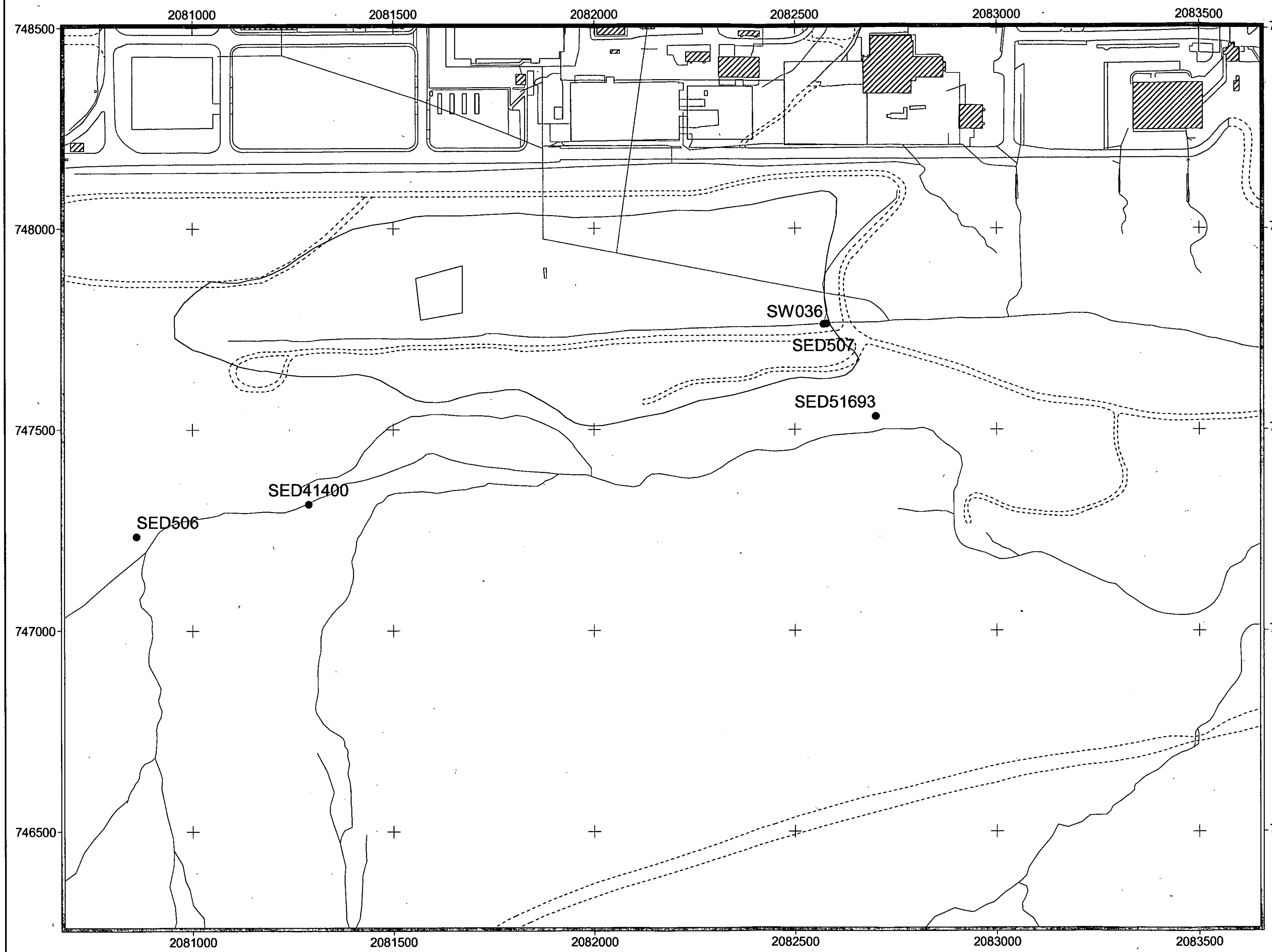
Figure 4-5
Sediment Locations
Original Landfill Area



KEY

- Sediment Location
- Paved road
- Dirt road
- Stream
- Demolished building
- Standing building
- IHSS

150 0 150 300 Feet

Scale = 1: 5000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by: Date: June 2004

RADMS

Prepared for:

KAISER•HILL COMPANY

File: W:\Projects\Fy2003\SW-2\Remediation\olf_max_concs-061704.apr

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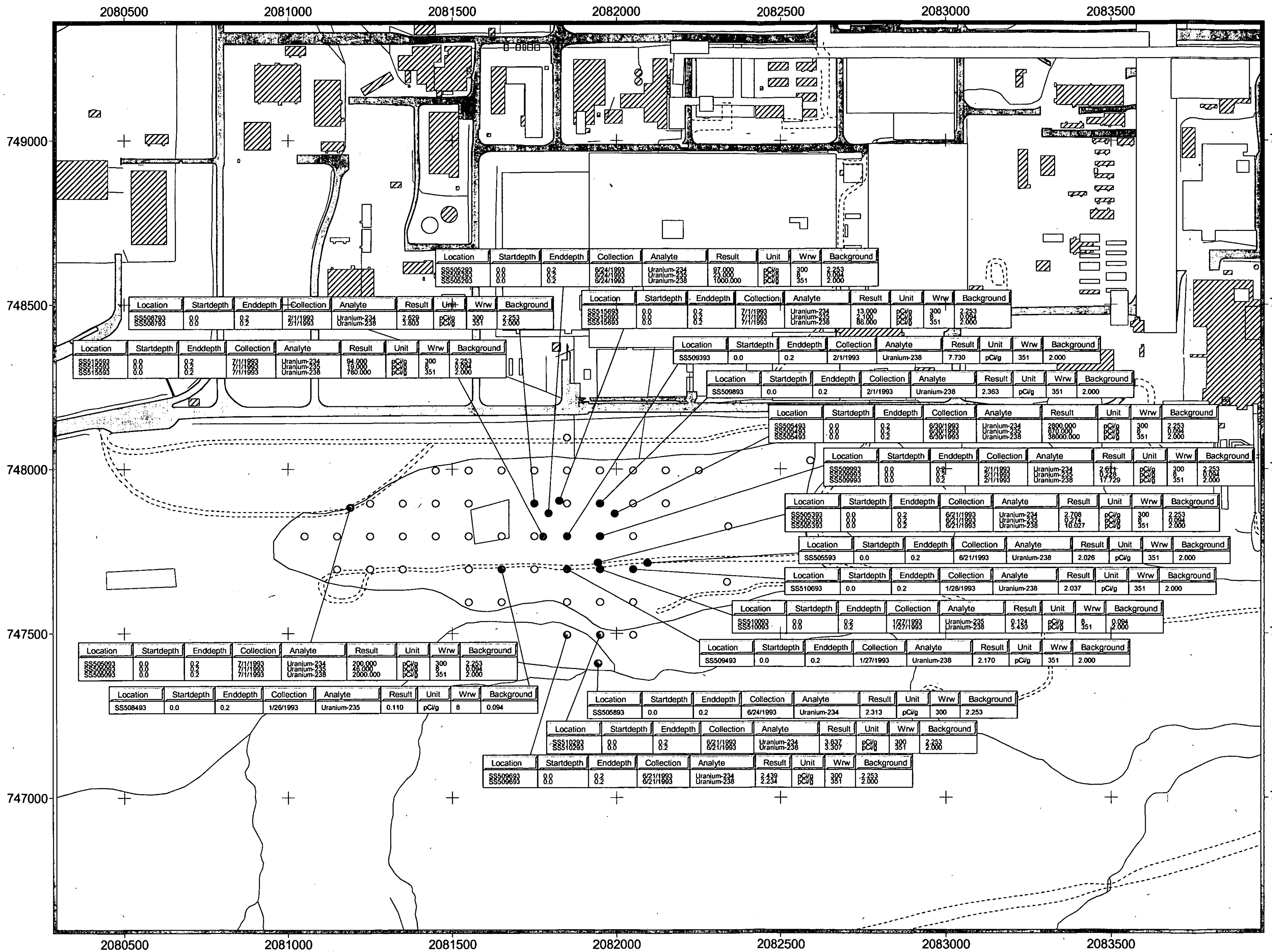

Figure 4-6
Uranium Concentrations Above Background in Surface Soil

KEY

- Concentration Greater Than Wildlife Refuge Worker Action Level
- Concentration Greater Than Background
- Concentration Less Than Background
- Dirt Road
- Stream
- IHSS
- Paved Road

Structure
- Demolished
- Standing

All isotope concentrations are shown when any one of the isotope concentrations exceeds background.

N
W E
S

200 0 200 Feet

Scale = 1:3700

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:

RADMS

10.06.04

Prepared for:

KAISER•HILL
COMPANY

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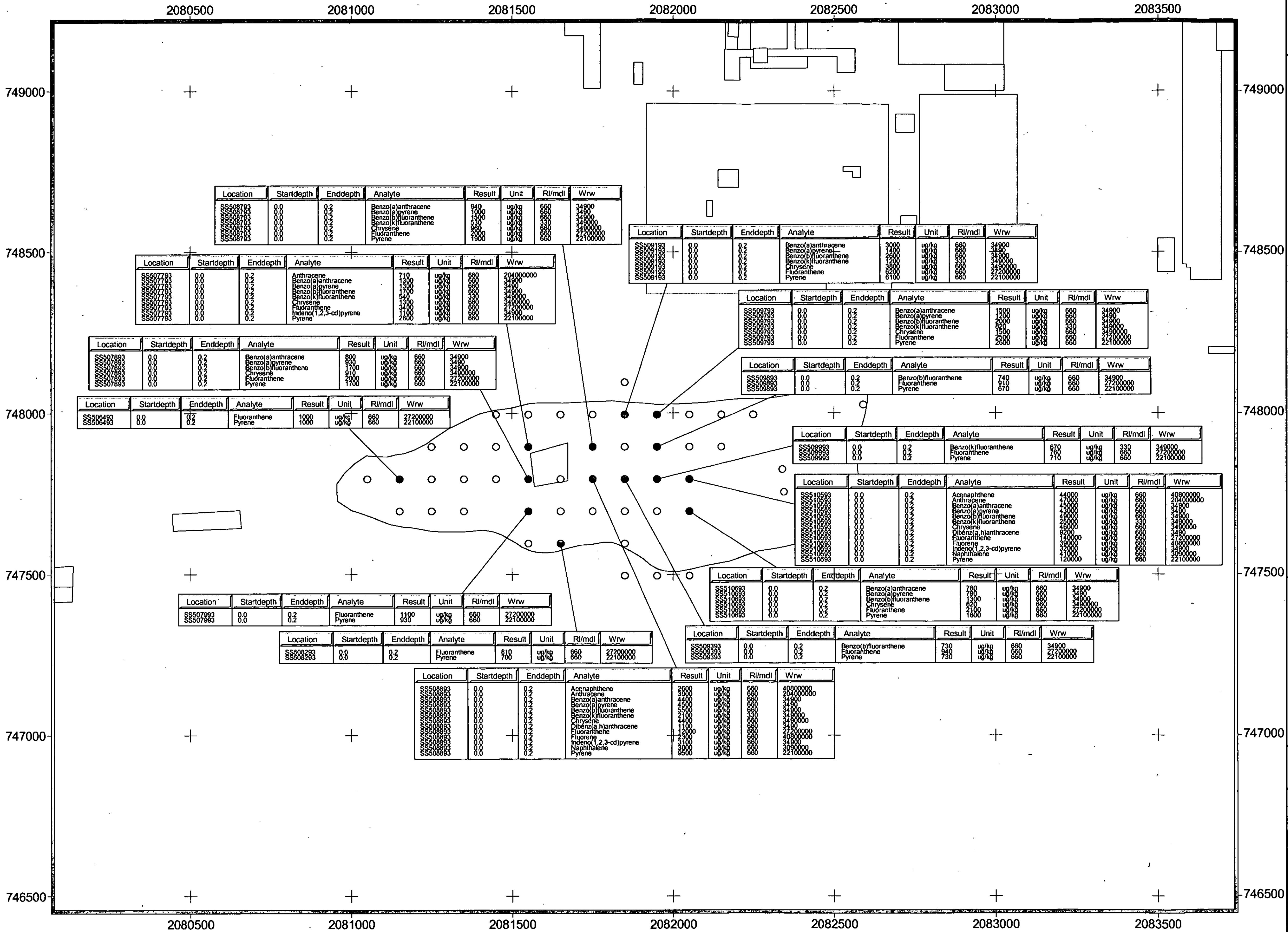
Figure 4-7
Polynuclear Aromatic Hydrocarbon Concentrations Above Background in Surface Soil



Location	Startdepth	Enddepth	Analyte	Result	Unit	Rl/mdl	Wrw
SS508793	0.0	0.2	Benzo(a)anthracene	940	ug/kg	660	34900
SS508793	0.0	0.2	Benzo(a)pyrene	1000	ug/kg	660	3490
SS508793	0.0	0.2	Benzo(b)fluoranthene	1500	ug/kg	660	34900
SS508793	0.0	0.2	Benzo(k)fluoranthene	530	ug/kg	330	349000
SS508793	0.0	0.2	Chrysene	960	ug/kg	660	3490000
SS508793	0.0	0.2	Fluoranthene	2000	ug/kg	660	27200000
SS508793	0.0	0.2	Pyrene	1900	ug/kg	660	22100000

Location	Startdepth	Enddepth	Analyte	Result	Unit	Rl/mdl	Wrw
SS507793	0.0	0.2	Anthracene	710	ug/kg	660	204000000
SS507793	0.0	0.2	Benzo(a)anthracene	1300	ug/kg	660	34900
SS507793	0.0	0.2	Benzo(a)pyrene	1300	ug/kg	660	3490
SS507793	0.0	0.2	Benzo(b)fluoranthene	1700	ug/kg	660	34900
SS507793	0.0	0.2	Benzo(k)fluoranthene	540	ug/kg	330	349000
SS507793	0.0	0.2	Chrysene	1300	ug/kg	660	3490000
SS507793	0.0	0.2	Fluoranthene	3400	ug/kg	660	27200000
SS507793	0.0	0.2	Indeno(1,2,3-cd)pyrene	1100	ug/kg	660	34900
SS507793	0.0	0.2	Pyrene	2600	ug/kg	660	22100000

Location	Startdepth	Enddepth	Analyte	Result	Unit	Rl/mdl	Wrw
SS507893	0.0	0.2	Benzo(a)anthracene	800	ug/kg	660	34900
SS507893	0.0	0.2	Benzo(a)pyrene	930	ug/kg	660	3490
SS507893	0.0	0.2	Benzo(b)fluoranthene	1700	ug/kg	660	34900
SS507893	0.0	0.2	Chrysene	910	ug/kg	660	3490000
SS507893	0.0	0.2	Fluoranthene	2000	ug/kg	660	27200000
SS507893	0.0	0.2	Pyrene	1700	ug/kg	660	22100000

Location	Startdepth	Enddepth	Analyte	Result	Unit	Rl/mdl	Wrw
SS506493	0.0	0.2	Fluoranthene	1000	ug/kg	660	27200000
SS506493	0.0	0.2	Pyrene	1000	ug/kg	660	22100000

Location	Startdepth	Enddepth	Analyte	Result	Unit	Rl/mdl	Wrw
SS509193	0.0	0.2	Benzo(a)anthracene	3000	ug/kg	660	34900
SS509193	0.0	0.2	Benzo(a)pyrene	1400	ug/kg	660	3490
SS509193	0.0	0.2	Benzo(b)fluoranthene	2600	ug/kg	660	34900
SS509193	0.0	0.2	Benzo(k)fluoranthene	1200	ug/kg	330	349000
SS509193	0.0	0.2	Chrysene	3800	ug/kg	660	3490000
SS509193	0.0	0.2	Fluoranthene	6200	ug/kg	660	27200000
SS509193	0.0	0.2	Pyrene	6100	ug/kg	660	22100000

Location	Startdepth	Enddepth	Analyte	Result	Unit	Rl/mdl	Wrw
SS509793	0.0	0.2	Benzo(a)anthracene	1500	ug/kg	660	34900
SS509793	0.0	0.2	Benzo(a)pyrene	1200	ug/kg	660	3490
SS509793	0.0	0.2	Benzo(b)fluoranthene	2000	ug/kg	660	34900
SS509793	0.0	0.2	Benzo(k)fluoranthene	820	ug/kg	330	349000
SS509793	0.0	0.2	Chrysene	1500	ug/kg	660	3490000
SS509793	0.0	0.2	Fluoranthene	2500	ug/kg	660	27200000
SS509793	0.0	0.2	Pyrene	2600	ug/kg	660	22100000

Location	Startdepth	Enddepth	Analyte	Result	Unit	Rl/mdl	Wrw
SS509893	0.0	0.2	Benzo(b)fluoranthene	740	ug/kg	660	34900
SS509893	0.0	0.2	Fluoranthene	910	ug/kg	660	27200000
SS509893	0.0	0.2	Pyrene	670	ug/kg	660	22100000

Location	Startdepth	Enddepth	Analyte	Result	Unit	Rl/mdl	Wrw
SS509993	0.0	0.2	Benzo(k)fluoranthene	670	ug/kg	330	349000
SS509993	0.0	0.2	Fluoranthene	760	ug/kg	660	27200000
SS509993	0.0	0.2	Pyrene	710	ug/kg	660	22100000

Location	Startdepth	Enddepth	Analyte	Result	Unit	Rl/mdl	Wrw
SS510593	0.0	0.2	Acenaphthene	44000	ug/kg	660	40800000
SS510593	0.0	0.2	Anthracene	47000	ug/kg	660	204000000
SS510593	0.0	0.2	Benzo(a)anthracene	45000	ug/kg	660	34900
SS510593	0.0	0.2	Benzo(a)pyrene	43000	ug/kg	660	3490
SS510593	0.0	0.2	Benzo(b)fluoranthene	49000	ug/kg	660	34900
SS510593	0.0	0.2	Benzo(k)fluoranthene	25000	ug/kg	330	349000
SS510593	0.0	0.2	Chrysene	46000	ug/kg	660	3490000
SS510593	0.0	0.2	Dibenz(a,h)anthracene	9200	ug/kg	660	3490
SS510593	0.0	0.2	Fluoranthene	140000	ug/kg	660	27200000
SS510593	0.0	0.2	Fluorene	39000	ug/kg	660	40800000
SS510593	0.0	0.2	Indeno(1,2,3-cd)pyrene	32000	ug/kg	660	34900
SS510593	0.0	0.2	Naphthalene	41000	ug/kg	660	3090000
SS510593	0.0	0.2	Pyrene	120000	ug/kg	660	22100000

Location	Startdepth	Enddepth	Analyte	Result	Unit	Rl/mdl	Wrw
SS510693	0.0	0.2	Benzo(a)anthracene	780	ug/kg	660	34900
SS510693	0.0	0.2	Benzo(a)pyrene	790	ug/kg	660	3490
SS510693	0.0	0.2	Benzo(b)fluoranthene	1300	ug/kg	660	34900
SS510693	0.0	0.2	Chrysene	820	ug/kg	660	3490000
SS510693	0.0	0.2	Fluoranthene	2100	ug/kg	660	27200000
SS510693	0.0	0.2	Pyrene	1600	ug/kg	660	22100000

Location	Startdepth	Enddepth	Analyte	Result	Unit	Rl/mdl	Wrw
SS507993	0.0	0.2	Fluoranthene	1100	ug/kg	660	27200000
SS507993	0.0	0.2	Pyrene	930	ug/kg	660	22100000

Location	Startdepth	Enddepth	Analyte	Result	Unit	Rl/mdl	Wrw
SS508293	0.0	0.2	Fluoranthene	810	ug/kg	660	27200000
SS508293	0.0	0.2	Pyrene	700	ug/kg	660	22100000

Location	Startdepth	Enddepth	Analyte	Result	Unit	Rl/mdl	Wrw
SS509393	0.0	0.2	Benzo(b)fluoranthene	730	ug/kg	660	34900
SS509393	0.0	0.2	Fluoranthene	940	ug/kg	660	27200000
SS509393	0.0	0.2	Pyrene	730	ug/kg	660	22100000

Location	Startdepth	Enddepth	Analyte	Result	Unit	Rl/mdl	Wrw
SS508893	0.0	0.2	Acenaphthene	2600	ug/kg	660	40800000
SS508893	0.0	0.2	Anthracene	3000	ug/kg	660	204000000
SS508893	0.0	0.2	Benzo(a)anthracene	4400	ug/kg	660	34900
SS508893	0.0	0.2	Benzo(a)pyrene	4500	ug/kg	660	3490
SS508893	0.0	0.2	Benzo(b)fluoranthene	5500	ug/kg	660	34900
SS508893	0.0	0.2	Benzo(k)fluoranthene	2100	ug/kg	330	349000
SS508893	0.0	0.2	Chrysene	4400	ug/kg	660	3490000
SS508893	0.0	0.2	Dibenz(a,h)anthracene	1100	ug/kg	660	3490
SS508893	0.0	0.2	Fluoranthene	12000	ug/kg	660	27200000
SS508893	0.0	0.2	Fluorene	2300	ug/kg	660	40800000
SS508893	0.0	0.2	Indeno(1,2,3-cd)pyrene	3100	ug/kg	660	34900
SS508893	0.0	0.2	Naphthalene	3000	ug/kg	660	3090000
SS508893	0.0	0.2	Pyrene	8500	ug/kg	660	22100000

KEY

- Concentration Greater Than Wildlife Refuge Worker Action Level
- Concentration Greater Than MDL/RL
- Concentration Less Than MDL/RL
- Dirt Road
- Stream
- IHSS
- Paved Road

Structure
- Demolished
- Standing

N
W E
S

250 0 250 Feet

Scale = 1:3700

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
RADMS

Date: 10.06.04

Prepared for:
KAISER+HILL COMPANY

File: w:\projects\fy2004\original_landfill\ev_projects\original_landfill_nfaa.apr

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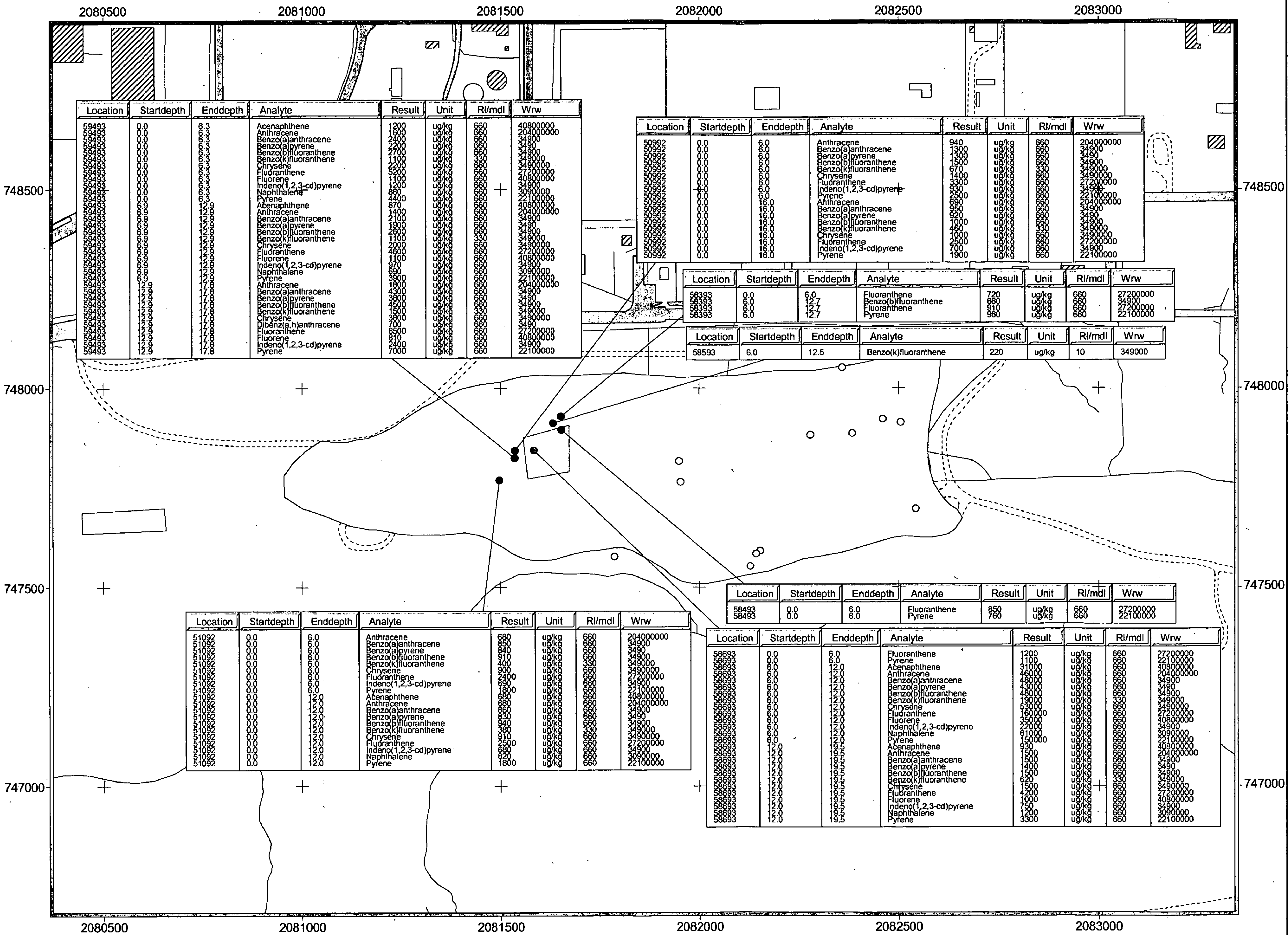
Figure 4-8
Polynuclear Aromatic Hydrocarbon Concentrations Above Background in Subsurface Soil



Location	Startdepth	Enddepth	Analyte	Result	Unit	Rl/mdl	Wrw
59493	0.0	6.3	Acenaphthene	1200	ug/kg	660	40800000
59493	0.0	6.3	Anthracene	1600	ug/kg	660	204000000
59493	0.0	6.3	Benzo(a)anthracene	2400	ug/kg	660	34900
59493	0.0	6.3	Benzo(a)pyrene	2200	ug/kg	660	3490
59493	0.0	6.3	Benzo(b)fluoranthene	2700	ug/kg	660	34900
59493	0.0	6.3	Benzo(k)fluoranthene	1100	ug/kg	330	349000
59493	0.0	6.3	Chrysene	2200	ug/kg	660	3490000
59493	0.0	6.3	Fluoranthene	5200	ug/kg	660	27200000
59493	0.0	6.3	Fluorene	1100	ug/kg	660	40800000
59493	0.0	6.3	Indeno(1,2,3-cd)pyrene	1200	ug/kg	660	34900
59493	0.0	6.3	Naphthalene	860	ug/kg	660	3090000
59493	0.0	6.3	Pyrene	4400	ug/kg	660	22100000
59493	6.9	12.9	Acenaphthene	870	ug/kg	660	40800000
59493	6.9	12.9	Anthracene	1400	ug/kg	660	204000000
59493	6.9	12.9	Benzo(a)anthracene	2100	ug/kg	660	34900
59493	6.9	12.9	Benzo(a)pyrene	1900	ug/kg	660	3490
59493	6.9	12.9	Benzo(b)fluoranthene	2600	ug/kg	660	34900
59493	6.9	12.9	Benzo(k)fluoranthene	1100	ug/kg	330	349000
59493	6.9	12.9	Chrysene	2000	ug/kg	660	3490000
59493	6.9	12.9	Fluoranthene	4600	ug/kg	660	27200000
59493	6.9	12.9	Fluorene	1100	ug/kg	660	40800000
59493	6.9	12.9	Indeno(1,2,3-cd)pyrene	970	ug/kg	660	34900
59493	6.9	12.9	Naphthalene	690	ug/kg	660	3090000
59493	6.9	12.9	Pyrene	3900	ug/kg	660	22100000
59493	12.9	17.8	Anthracene	1800	ug/kg	660	204000000
59493	12.9	17.8	Benzo(a)anthracene	4300	ug/kg	660	34900
59493	12.9	17.8	Benzo(a)pyrene	3800	ug/kg	660	3490
59493	12.9	17.8	Benzo(b)fluoranthene	4500	ug/kg	660	34900
59493	12.9	17.8	Benzo(k)fluoranthene	1500	ug/kg	330	349000
59493	12.9	17.8	Chrysene	3800	ug/kg	660	3490000
59493	12.9	17.8	Dibenz(a,h)anthracene	700	ug/kg	660	3490
59493	12.9	17.8	Fluoranthene	8500	ug/kg	660	27200000
59493	12.9	17.8	Fluorene	810	ug/kg	660	40800000
59493	12.9	17.8	Indeno(1,2,3-cd)pyrene	2400	ug/kg	660	34900
59493	12.9	17.8	Pyrene	7000	ug/kg	660	22100000

Location	Startdepth	Enddepth	Analyte	Result	Unit	Rl/mdl	Wrw
50992	0.0	6.0	Anthracene	940	ug/kg	660	204000000
50992	0.0	6.0	Benzo(a)anthracene	1300	ug/kg	660	34900
50992	0.0	6.0	Benzo(a)pyrene	1300	ug/kg	660	3490
50992	0.0	6.0	Benzo(b)fluoranthene	1500	ug/kg	660	34900
50992	0.0	6.0	Benzo(k)fluoranthene	670	ug/kg	330	349000
50992	0.0	6.0	Chrysene	1400	ug/kg	660	3490000
50992	0.0	6.0	Fluoranthene	3300	ug/kg	660	27200000
50992	0.0	6.0	Indeno(1,2,3-cd)pyrene	930	ug/kg	660	34900
50992	0.0	6.0	Pyrene	2500	ug/kg	660	22100000
50992	0.0	16.0	Anthracene	690	ug/kg	660	204000000
50992	0.0	16.0	Benzo(a)anthracene	950	ug/kg	660	34900
50992	0.0	16.0	Benzo(a)pyrene	920	ug/kg	660	3490
50992	0.0	16.0	Benzo(b)fluoranthene	1000	ug/kg	660	34900
50992	0.0	16.0	Benzo(k)fluoranthene	460	ug/kg	330	349000
50992	0.0	16.0	Chrysene	1000	ug/kg	660	3490000
50992	0.0	16.0	Fluoranthene	2500	ug/kg	660	27200000
50992	0.0	16.0	Indeno(1,2,3-cd)pyrene	700	ug/kg	660	34900
50992	0.0	16.0	Pyrene	1900	ug/kg	660	22100000

Location	Startdepth	Enddepth	Analyte	Result	Unit	Rl/mdl	Wrw
58393	0.0	6.0	Fluoranthene	720	ug/kg	660	27200000
58393	6.0	12.7	Benzo(b)fluoranthene	660	ug/kg	660	34900
58393	6.0	12.7	Fluoranthene	910	ug/kg	660	27200000
58393	6.0	12.7	Pyrene	960	ug/kg	660	22100000

Location	Startdepth	Enddepth	Analyte	Result	Unit	Rl/mdl	Wrw
58593	6.0	12.5	Benzo(k)fluoranthene	220	ug/kg	10	349000

Location	Startdepth	Enddepth	Analyte	Result	Unit	Rl/mdl	Wrw
51092	0.0	6.0	Anthracene	680	ug/kg	660	204000000
51092	0.0	6.0	Benzo(a)anthracene	850	ug/kg	660	34900
51092	0.0	6.0	Benzo(a)pyrene	840	ug/kg	660	3490
51092	0.0	6.0	Benzo(b)fluoranthene	910	ug/kg	660	34900
51092	0.0	6.0	Benzo(k)fluoranthene	400	ug/kg	330	349000
51092	0.0	6.0	Chrysene	900	ug/kg	660	3490000
51092	0.0	6.0	Fluoranthene	2400	ug/kg	660	27200000
51092	0.0	6.0	Indeno(1,2,3-cd)pyrene	690	ug/kg	660	34900
51092	0.0	6.0	Pyrene	1800	ug/kg	660	22100000
51092	0.0	12.0	Acenaphthene	680	ug/kg	660	40800000
51092	0.0	12.0	Anthracene	680	ug/kg	660	204000000
51092	0.0	12.0	Benzo(a)anthracene	860	ug/kg	660	34900
51092	0.0	12.0	Benzo(a)pyrene	830	ug/kg	660	3490
51092	0.0	12.0	Benzo(b)fluoranthene	940	ug/kg	660	34900
51092	0.0	12.0	Benzo(k)fluoranthene	380	ug/kg	330	349000
51092	0.0	12.0	Chrysene	910	ug/kg	660	3490000
51092	0.0	12.0	Fluoranthene	2500	ug/kg	660	27200000
51092	0.0	12.0	Indeno(1,2,3-cd)pyrene	680	ug/kg	660	34900
51092	0.0	12.0	Naphthalene	820	ug/kg	660	3090000
51092	0.0	12.0	Pyrene	1800	ug/kg	660	22100000

Location	Startdepth	Enddepth	Analyte	Result	Unit	Rl/mdl	Wrw
58493	0.0	6.0	Fluoranthene	850	ug/kg	660	27200000
58493	0.0	6.0	Pyrene	760	ug/kg	660	22100000

Location	Startdepth	Enddepth	Analyte	Result	Unit	Rl/mdl	Wrw
58693	0.0	6.0	Fluoranthene	1200	ug/kg	660	27200000
58693	0.0	6.0	Pyrene	1100	ug/kg	660	22100000
58693	6.0	12.0	Acenaphthene	31000	ug/kg	660	40800000
58693	6.0	12.0	Anthracene	46000	ug/kg	660	204000000
58693	6.0	12.0	Benzo(a)anthracene	48000	ug/kg	660	34900
58693	6.0	12.0	Benzo(a)pyrene	43000	ug/kg	660	3490
58693	6.0	12.0	Benzo(b)fluoranthene	48000	ug/kg	660	34900
58693	6.0	12.0	Benzo(k)fluoranthene	19000	ug/kg	330	349000
58693	6.0	12.0	Chrysene	53000	ug/kg	660	3490000
58693	6.0	12.0	Fluoranthene	160000	ug/kg	660	27200000
58693	6.0	12.0	Fluorene	35000	ug/kg	660	40800000
58693	6.0	12.0	Indeno(1,2,3-cd)pyrene	22000	ug/kg	660	34900
58693	6.0	12.0	Naphthalene	61000	ug/kg	660	3090000
58693	6.0	12.0	Pyrene	150000	ug/kg	660	22100000
58693	12.0	19.5	Acenaphthene	930	ug/kg	660	40800000
58693	12.0	19.5	Anthracene	1500	ug/kg	660	204000000
58693	12.0	19.5	Benzo(a)anthracene	1500	ug/kg	660	34900
58693	12.0	19.5	Benzo(a)pyrene	1400	ug/kg	660	3490
58693	12.0	19.5	Benzo(b)fluoranthene	1500	ug/kg	660	34900
58693	12.0	19.5	Benzo(k)fluoranthene	620	ug/kg	330	349000
58693	12.0	19.5	Chrysene	1500	ug/kg	660	3490000
58693	12.0	19.5	Fluoranthene	4200	ug/kg	660	27200000
58693	12.0	19.5	Fluorene	1000	ug/kg	660	40800000
58693	12.0	19.5	Indeno(1,2,3-cd)pyrene	750	ug/kg	660	34900
58693	12.0	19.5	Naphthalene	1200	ug/kg	660	3090000
58693	12.0	19.5	Pyrene	3300	ug/kg	660	22100000

KEY

- Concentration Greater Than Wildlife Refuge Worker Action Level
- Concentration Greater Than MDL/RL
- Concentration Less Than MDL/RL
- Dirt Road
- Stream
- IHSS
- Paved Road

Structure
- Demolished
- Standing

N
W
E
S

150 0 150 Feet

Scale = 1:3000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:

07.13.04

RADMS

Prepared for:

KAISER•HILL COMPANY

Figure 4-9 Dissolved Antimony in Groundwater

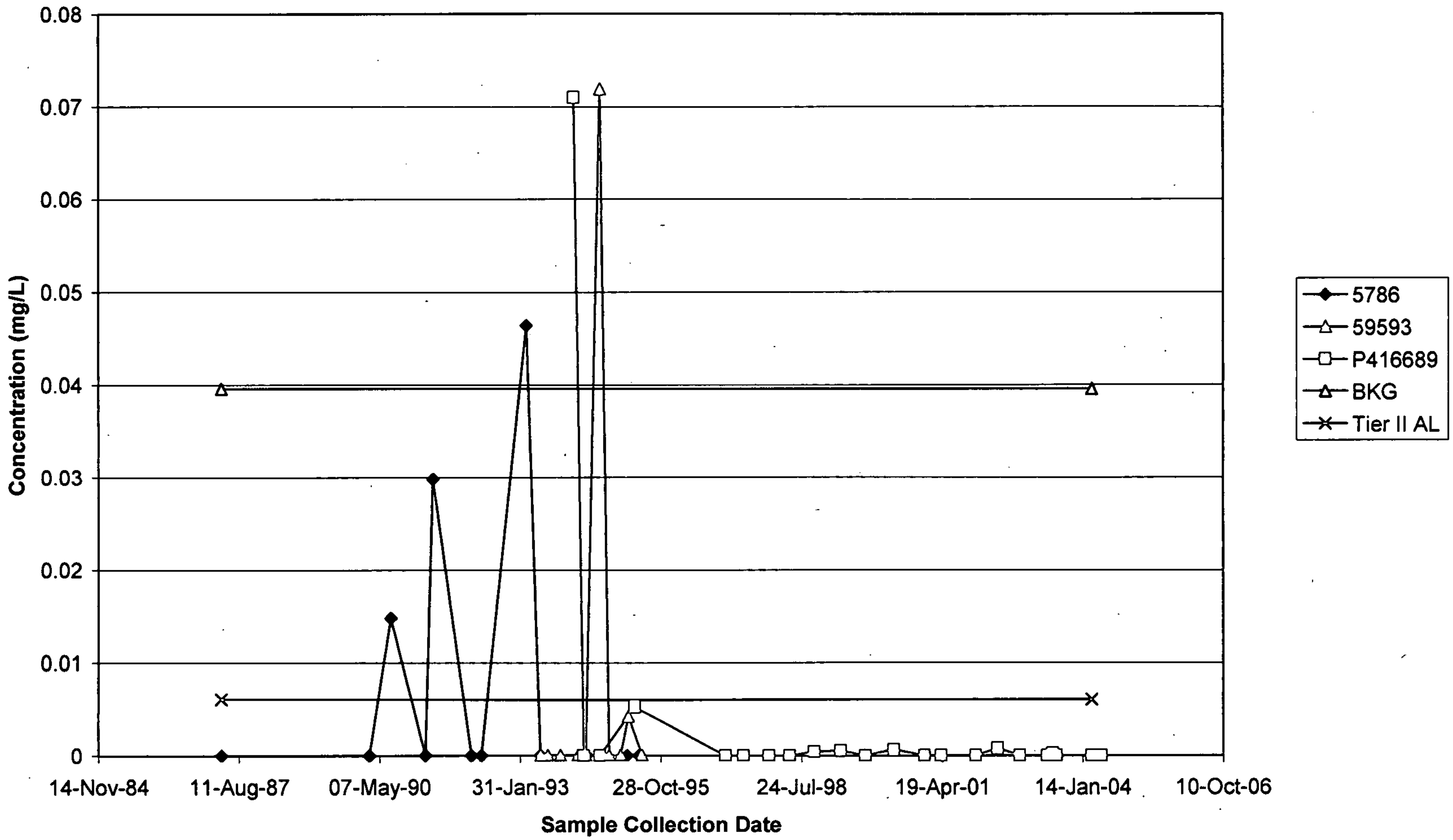


Figure 4-10 Dissolved Beryllium in Groundwater

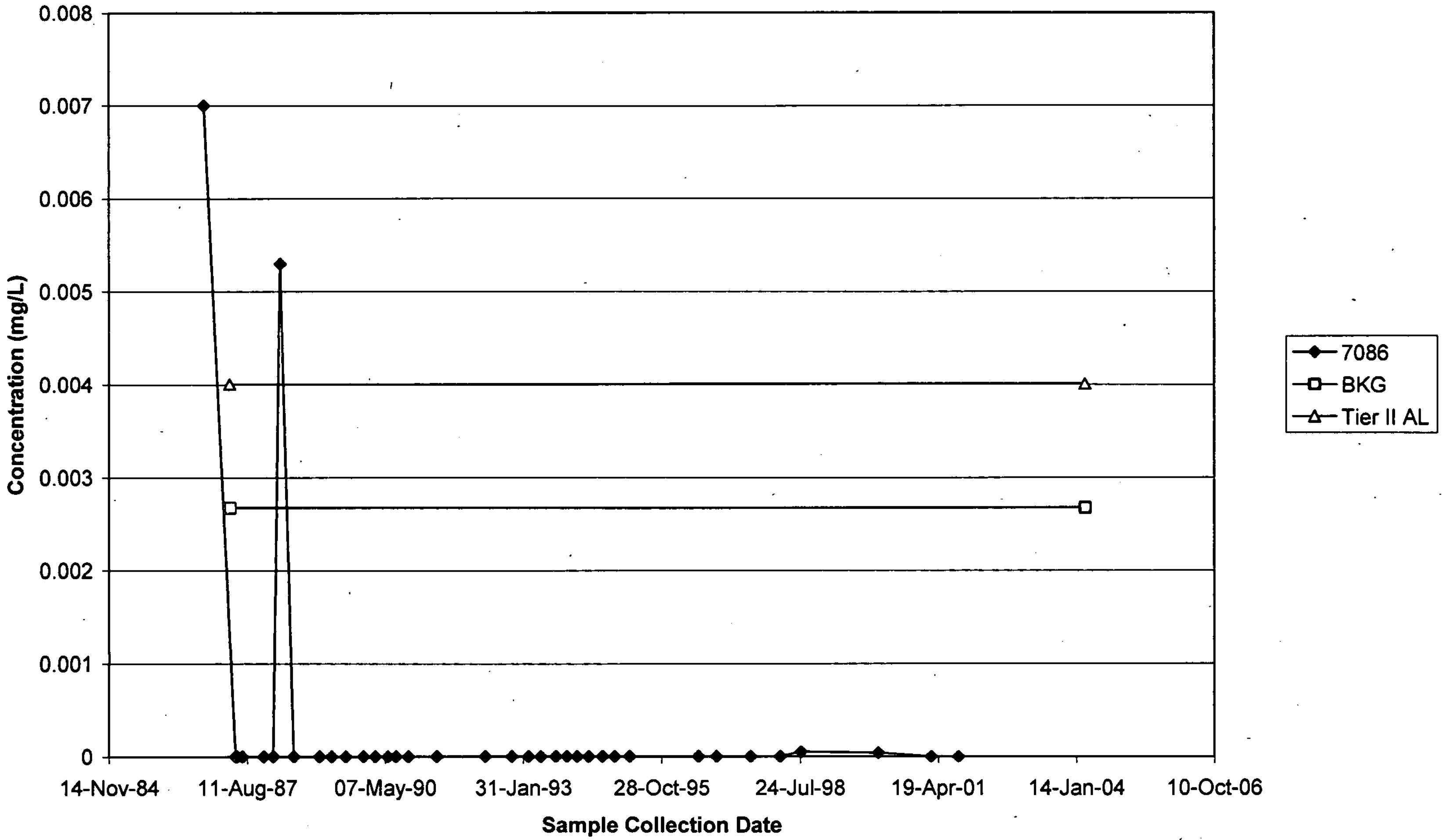


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Figure 4-11 Dissolved Cadmium in Groundwater

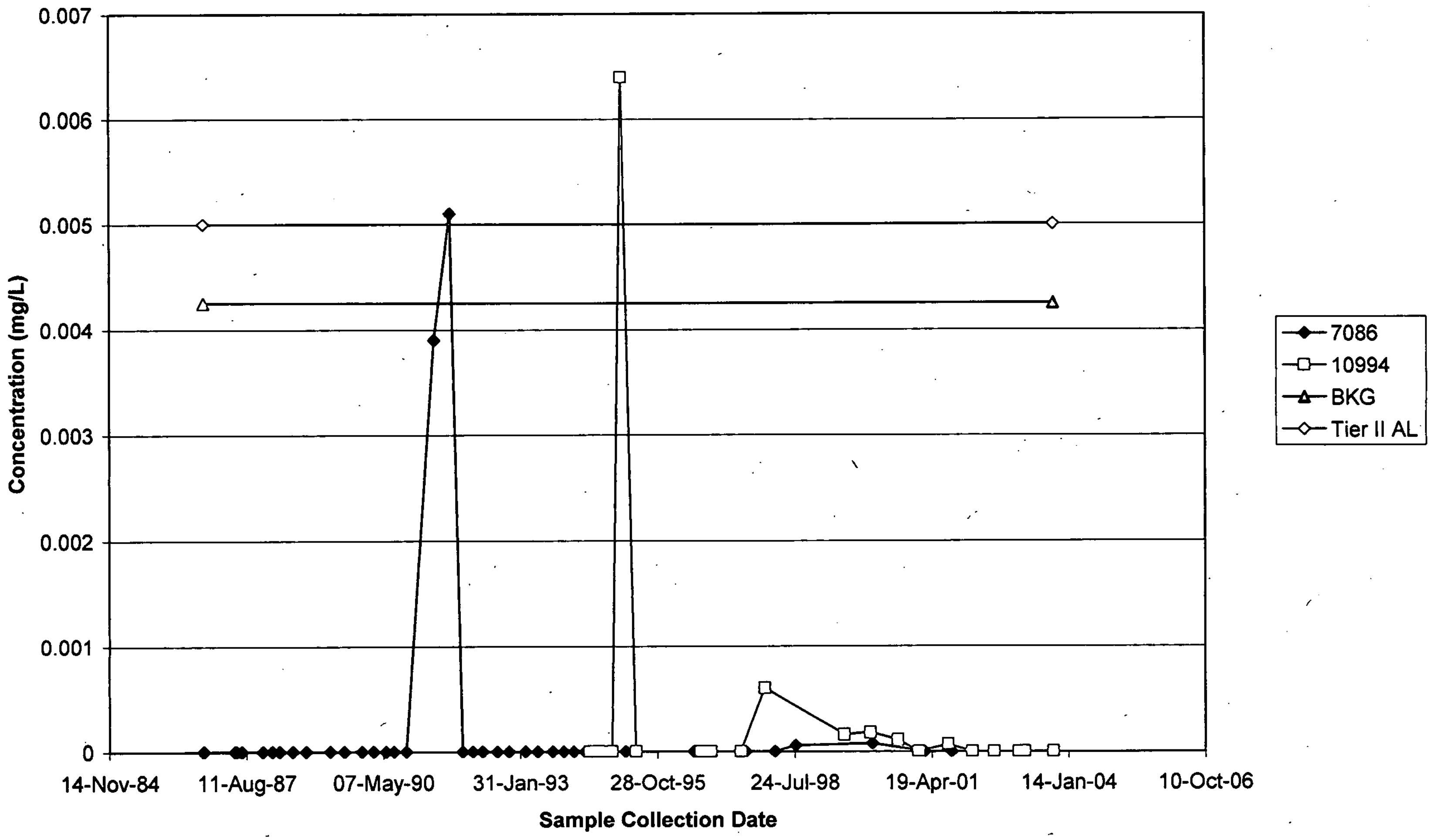

Figure 4-12 Dissolved Lead in Groundwater

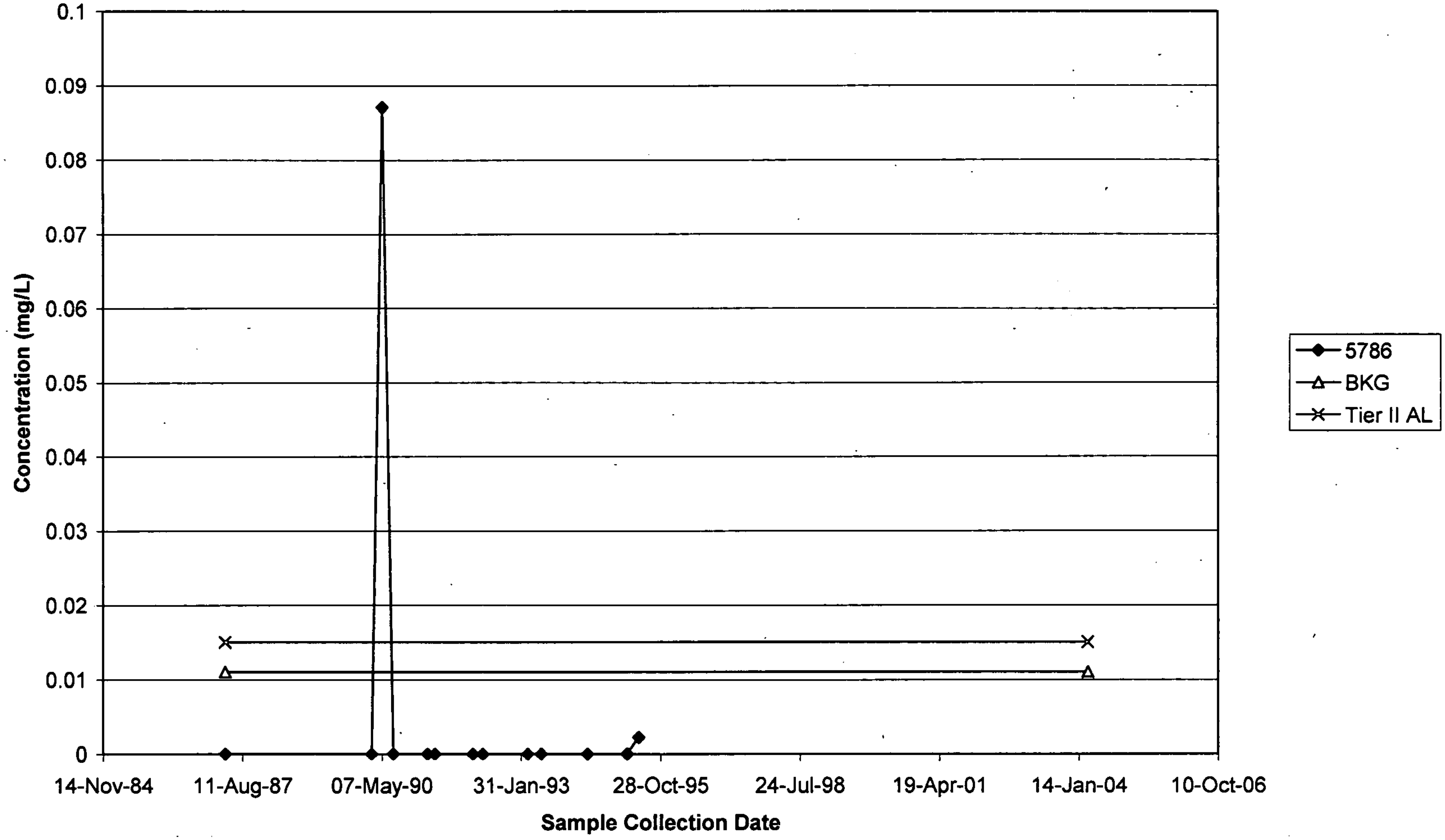

Figure 4-13 Dissolved Manganese in Groundwater

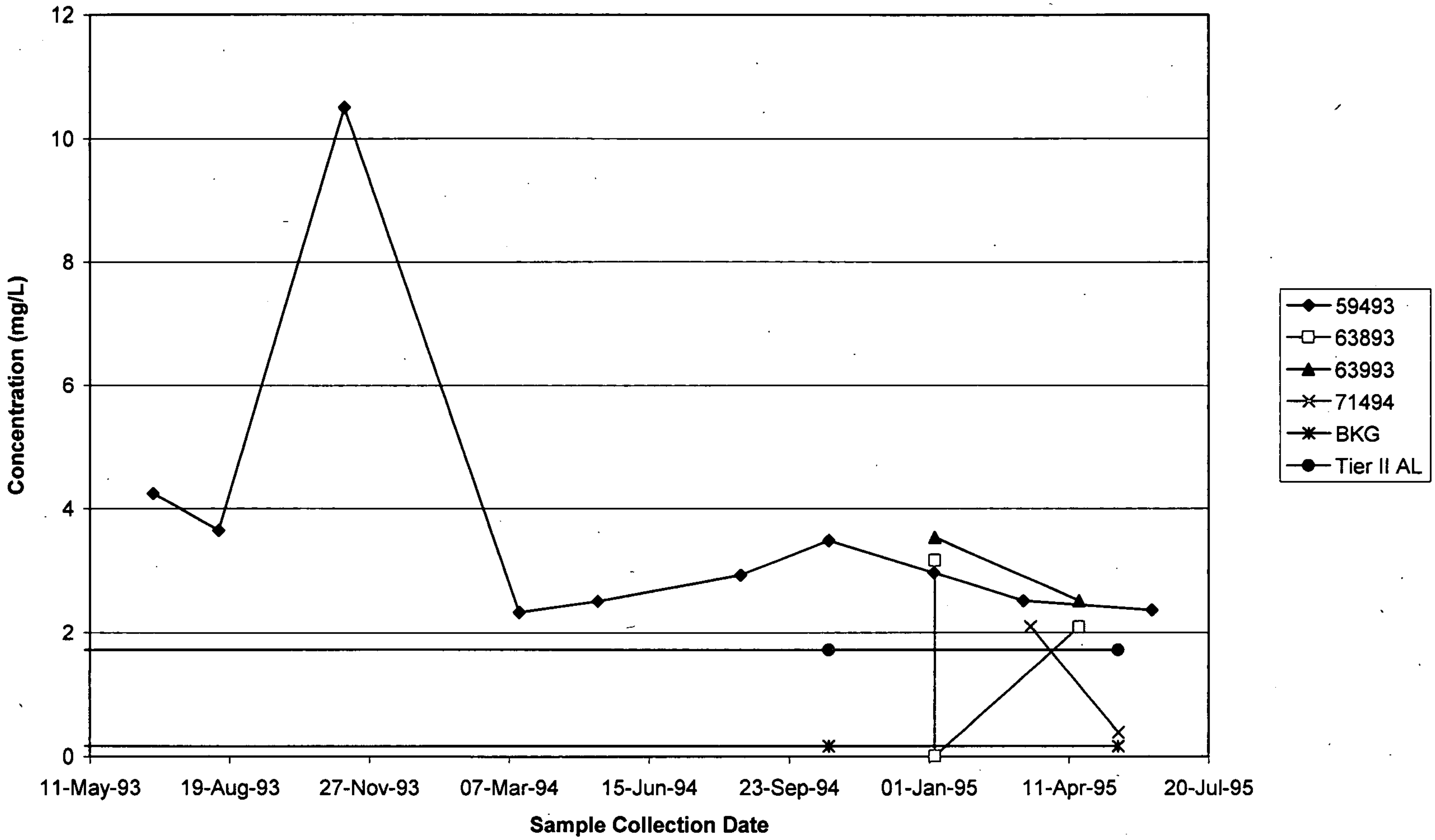

Figure 4-14 Dissolved Nickel in Groundwater

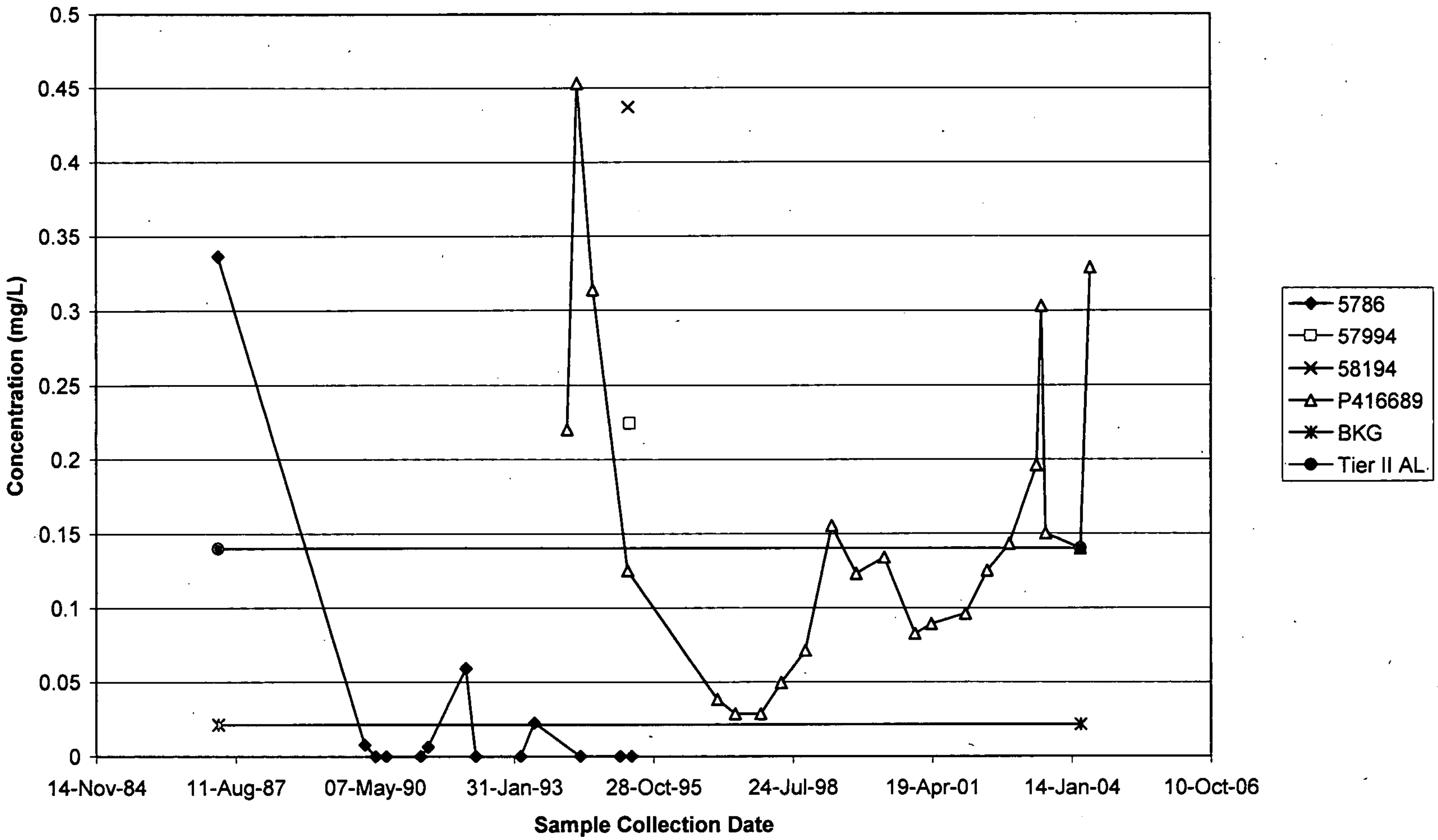

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Figure 4-15 Dissolved Selenium in Groundwater

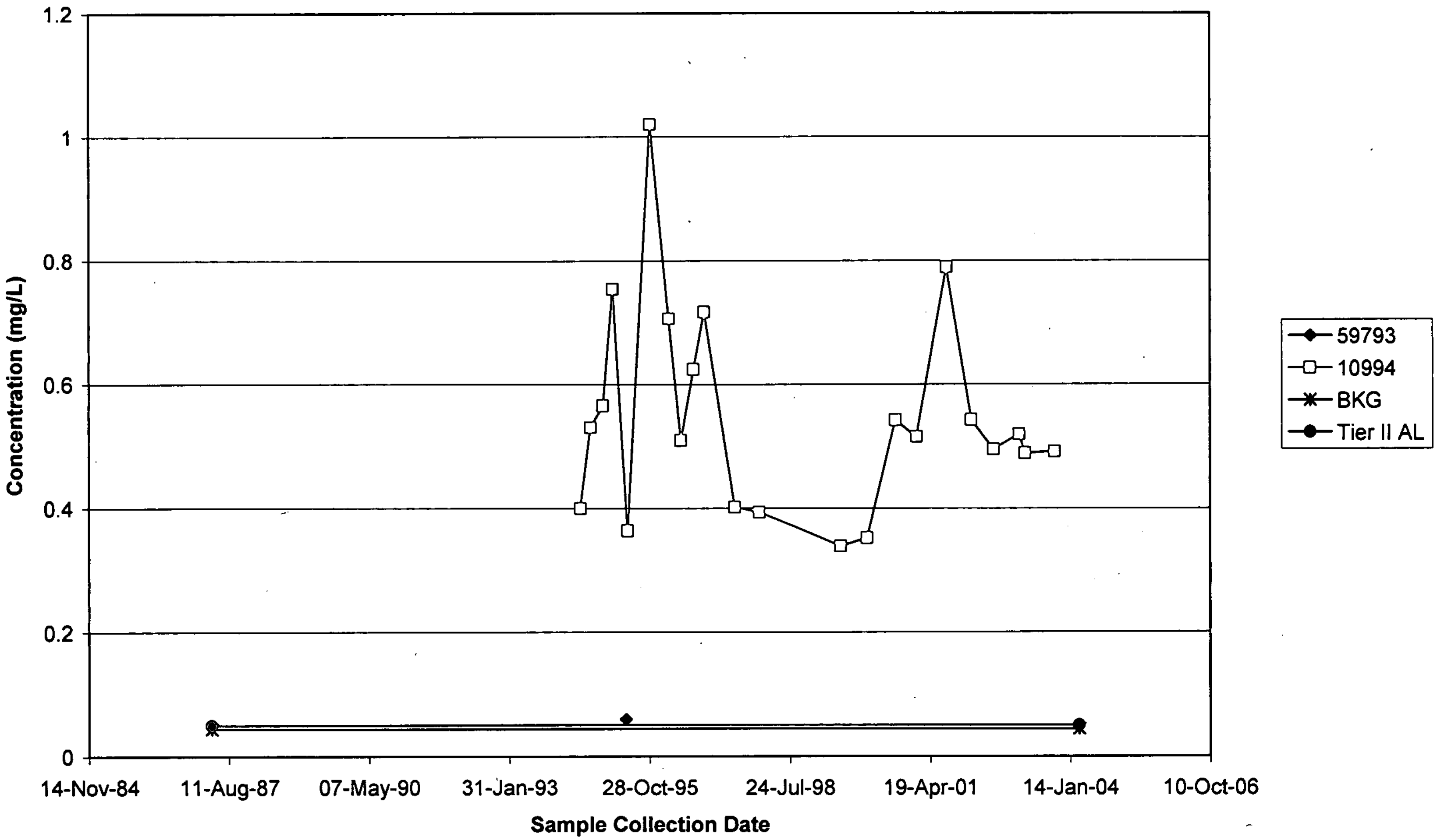


Figure 4-16 Dissolved Thallium in Groundwater

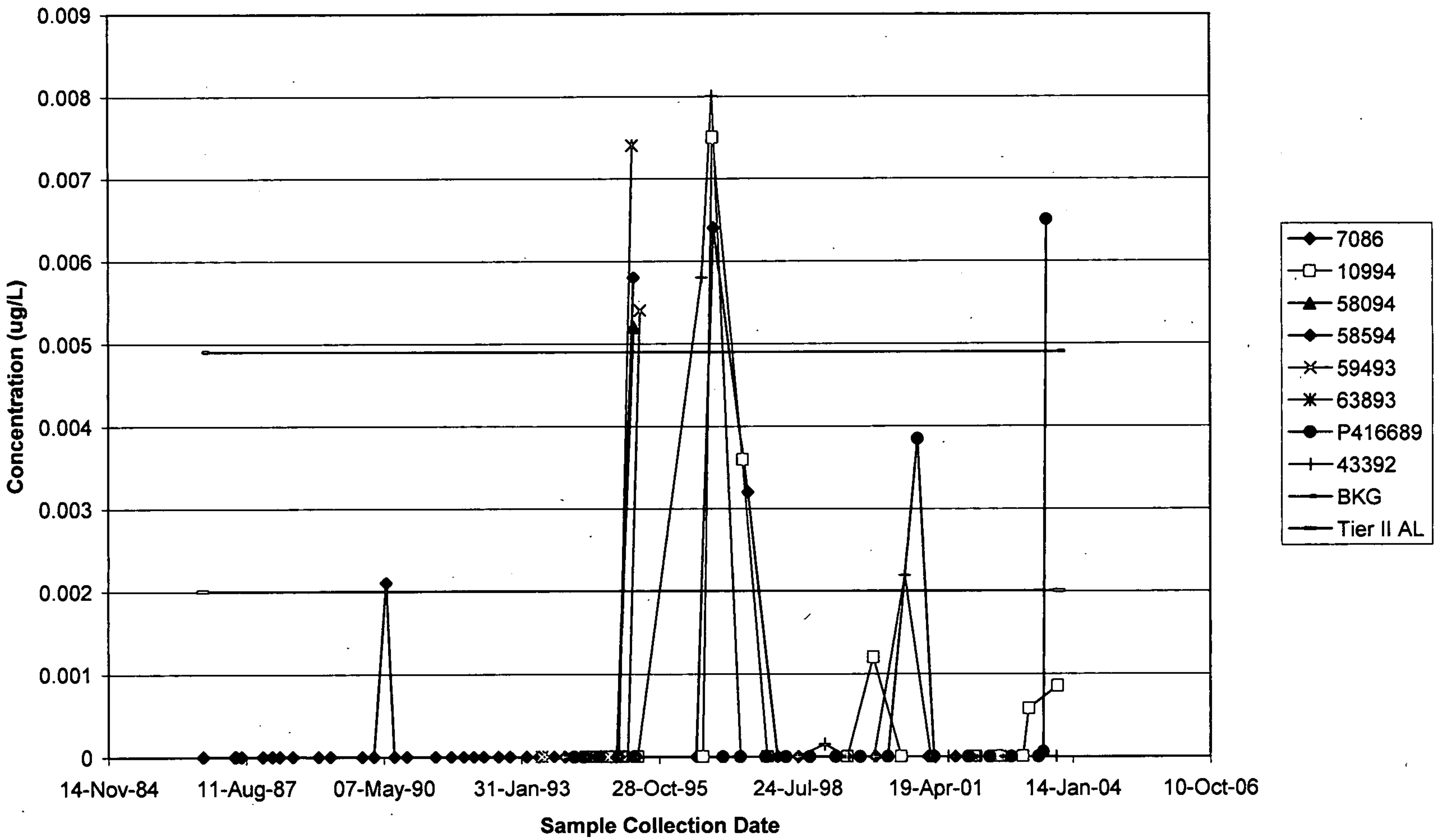


Figure 4-17 Dissolved Strontium-90 in Groundwater

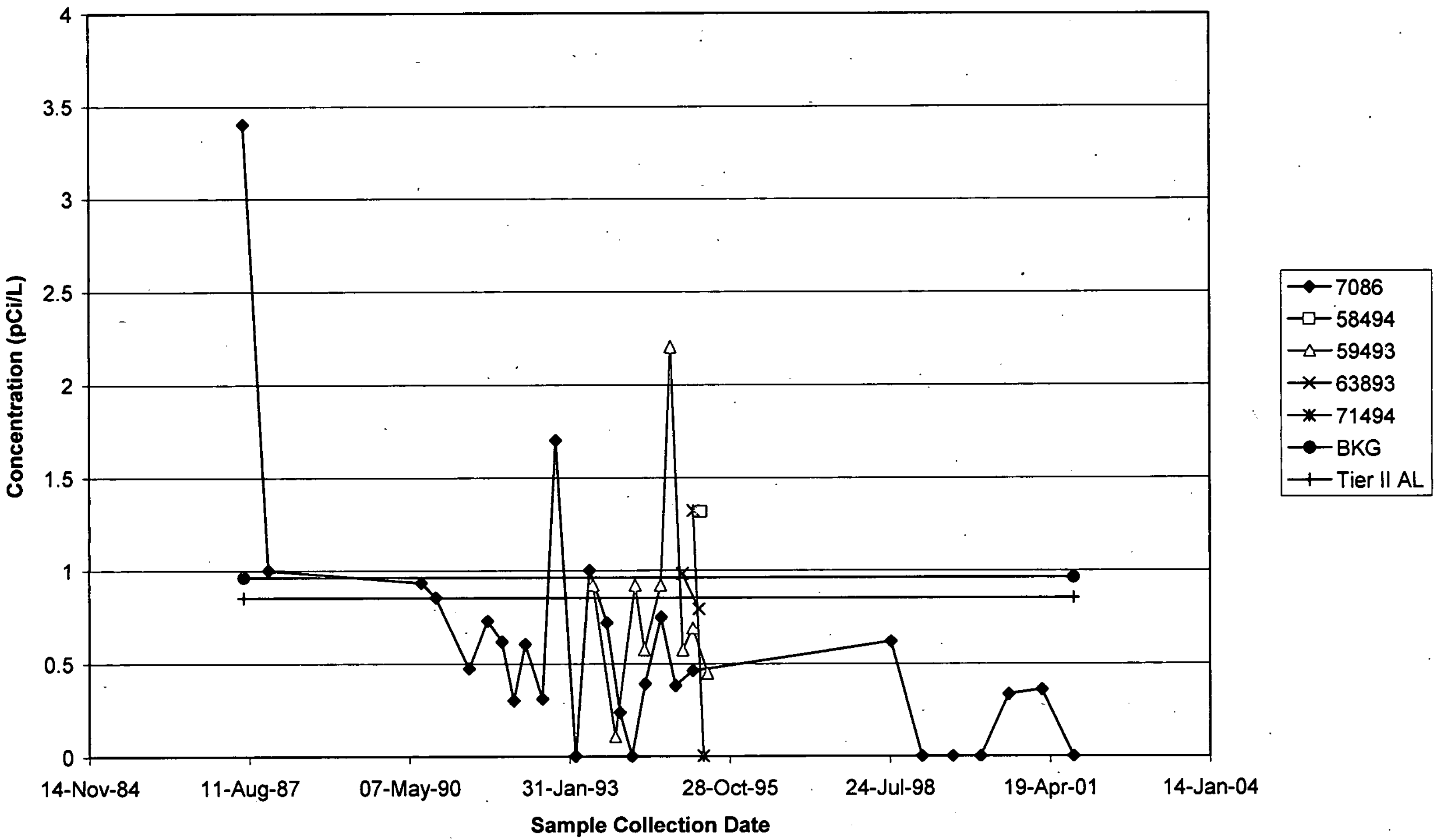


Figure 4-18 Dissolved Uranium Concentrations and Isotopic Activity Ratios in Groundwater at Well 61093

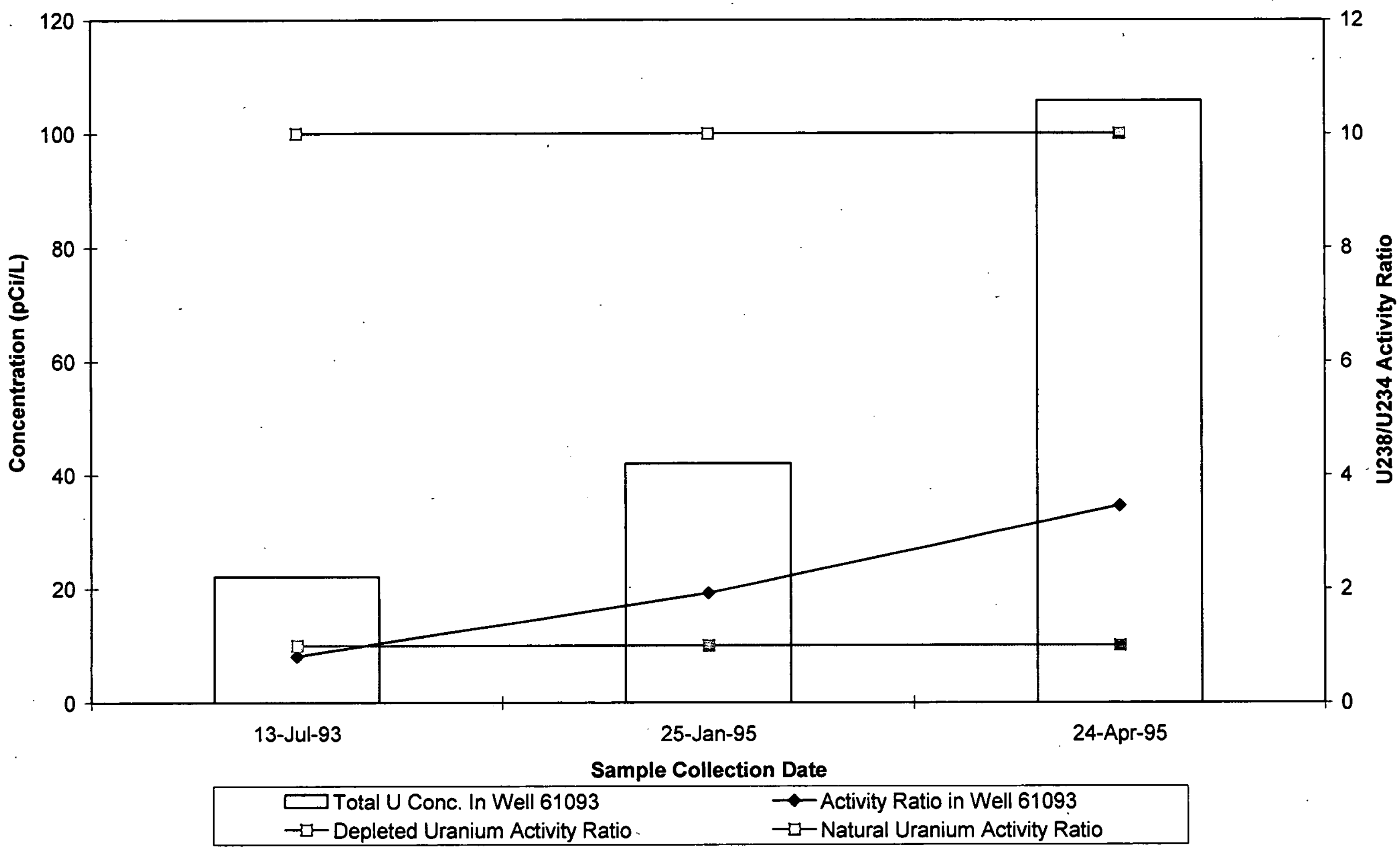


Figure 4-19 Dissolved Uranium Concentrations and Isotopic Mass Ratios in Groundwater at Well 61093

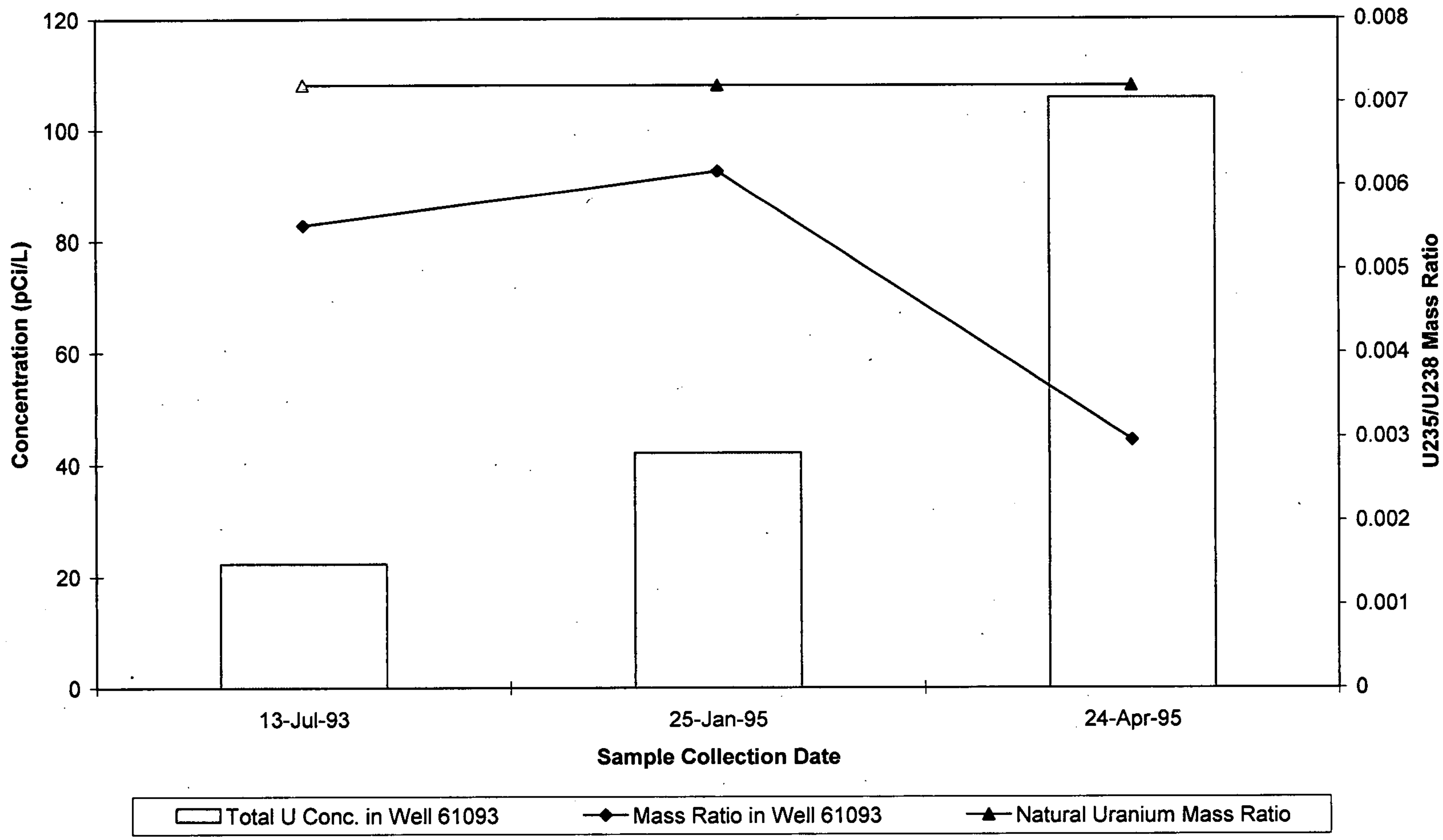


Figure 4-20 Total Uranium Concentrations and Isotopic Mass Ratios in Groundwater Measured by ICP MS

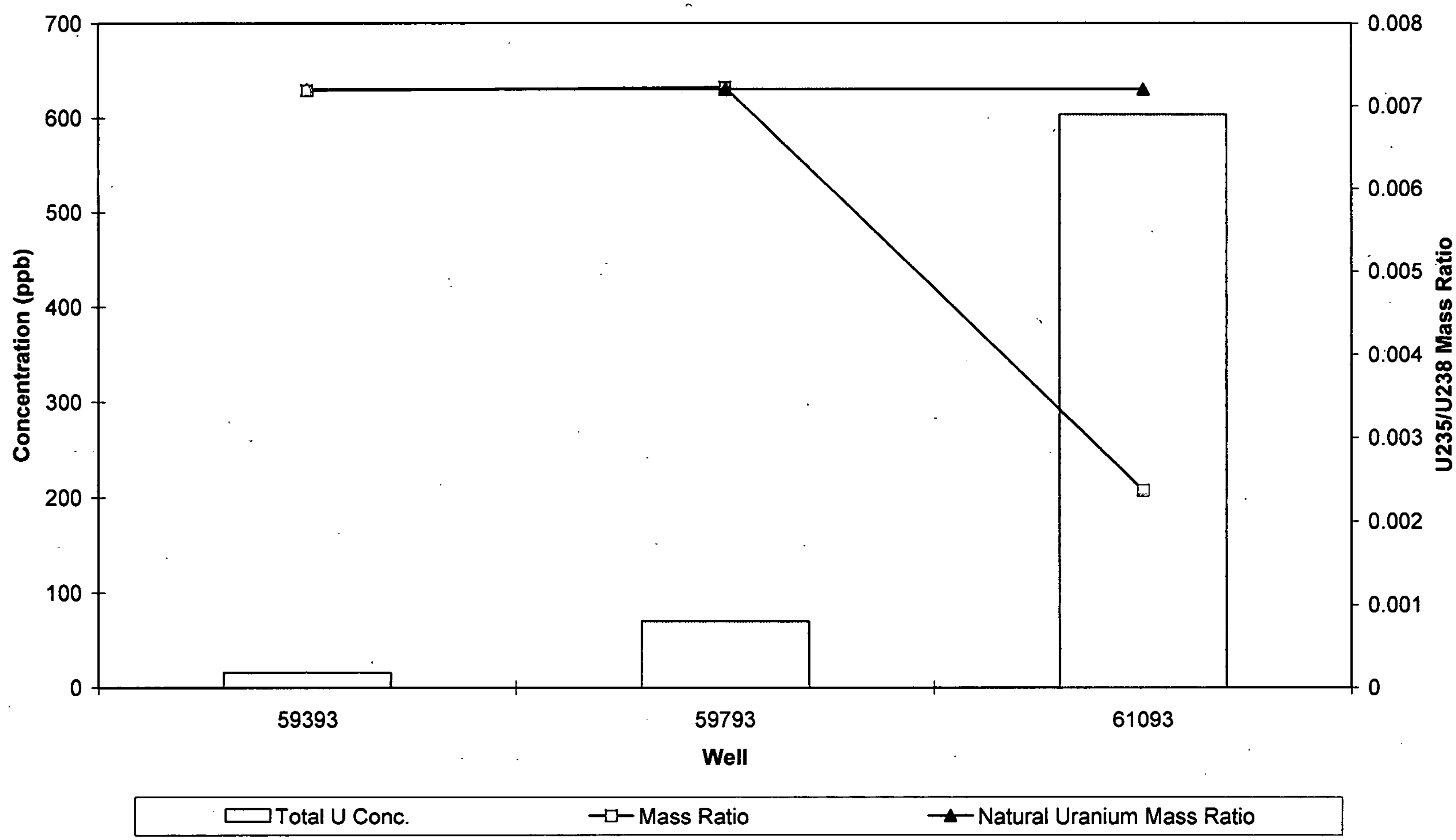


Figure 4-21 Dieldrin in Groundwater

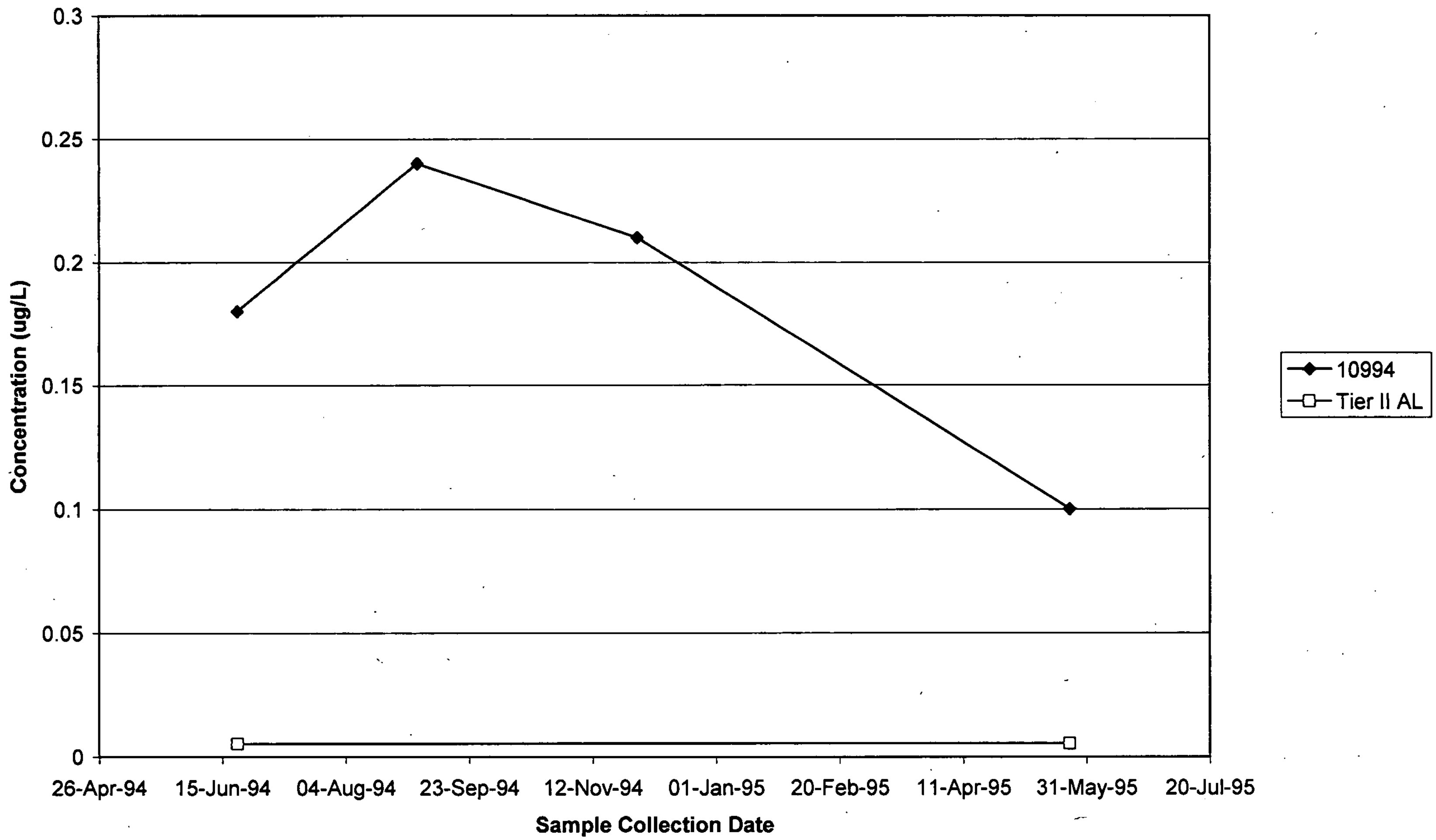


Figure 4-22 Bis(2-ethylhexyl)phthalate in Groundwater at Wells with a Tier II Exceedance

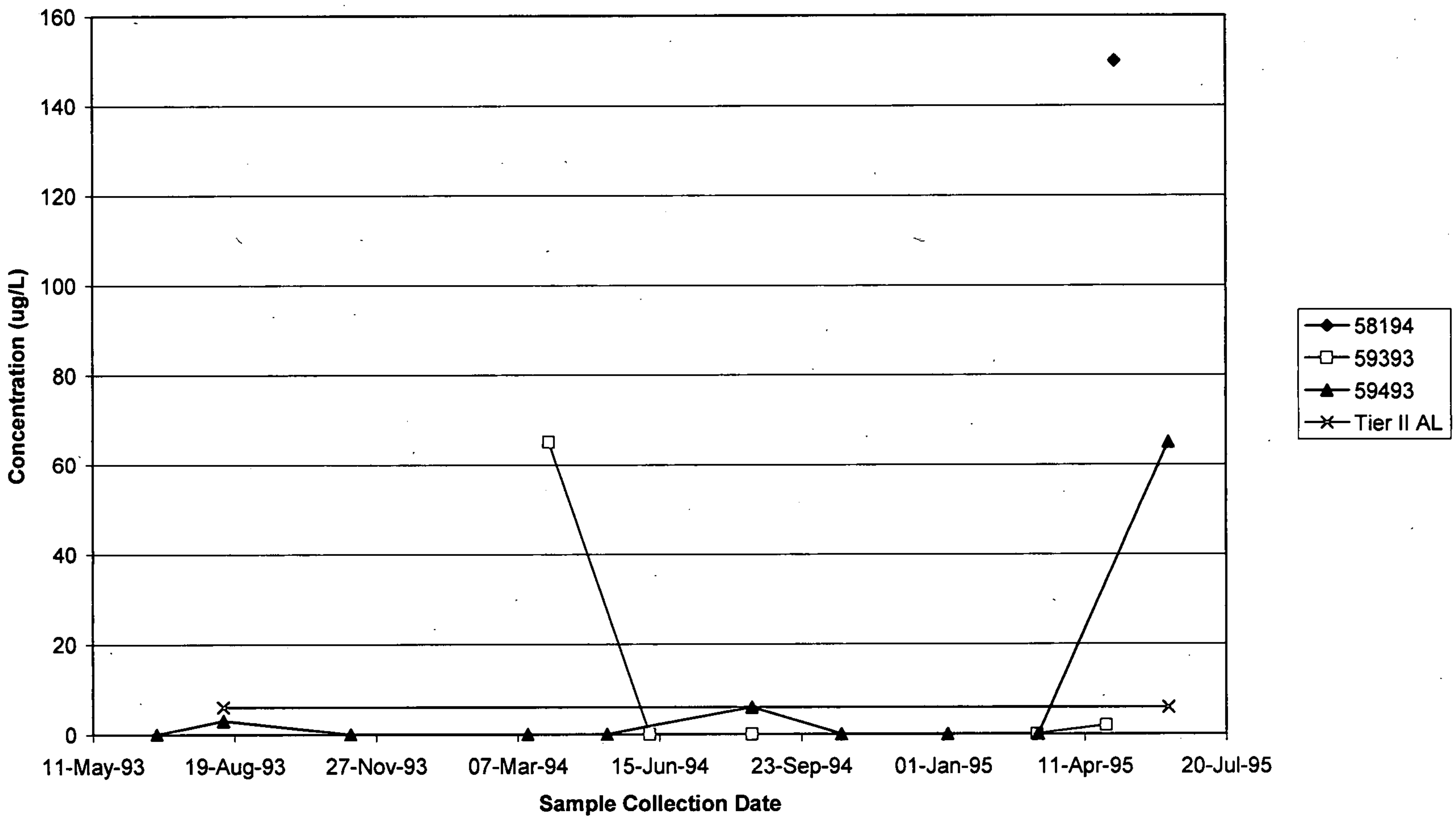


Figure 4-23 Tetrachloroethene in Groundwater at Wells with a Tier II Exceedance

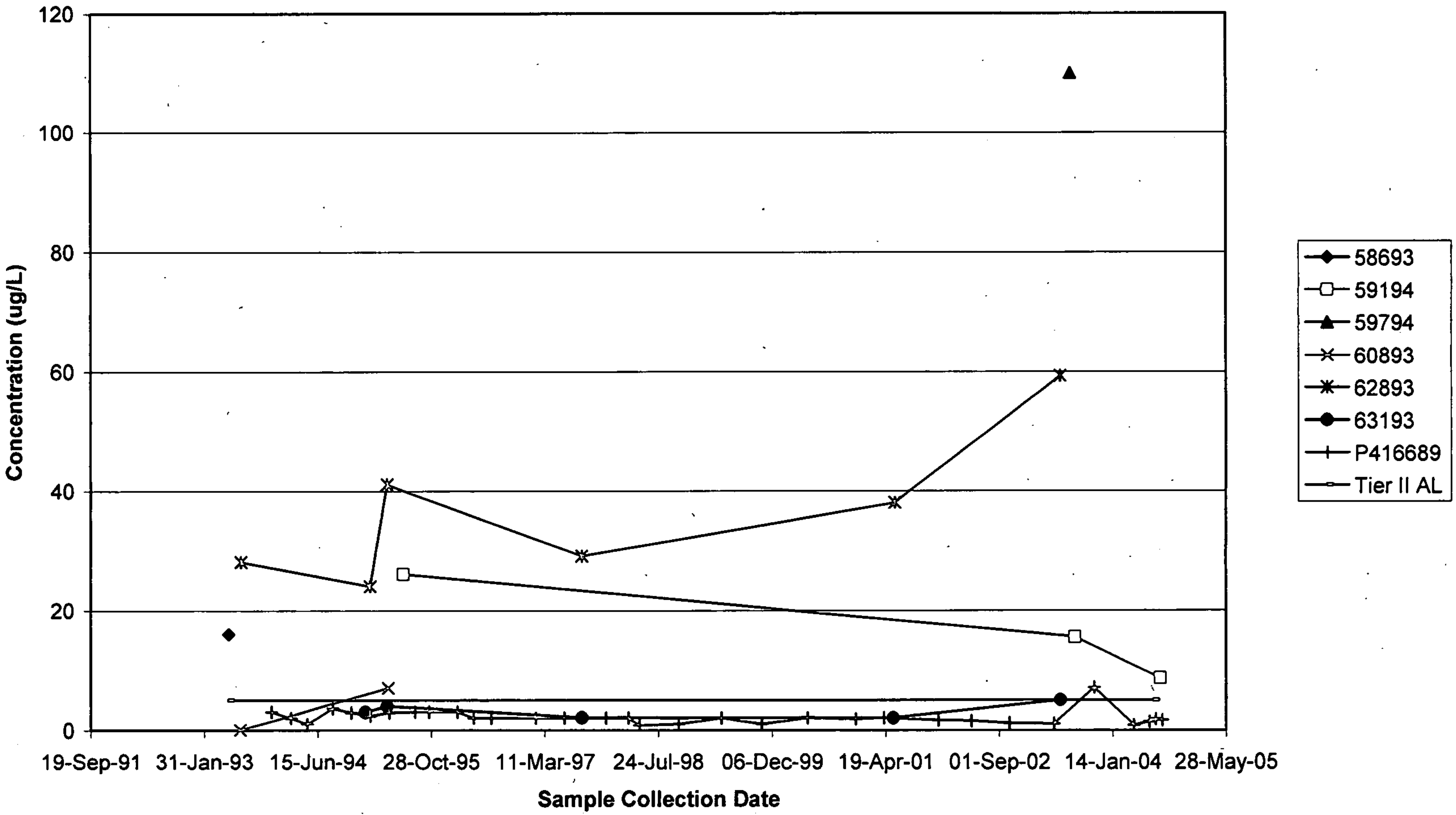
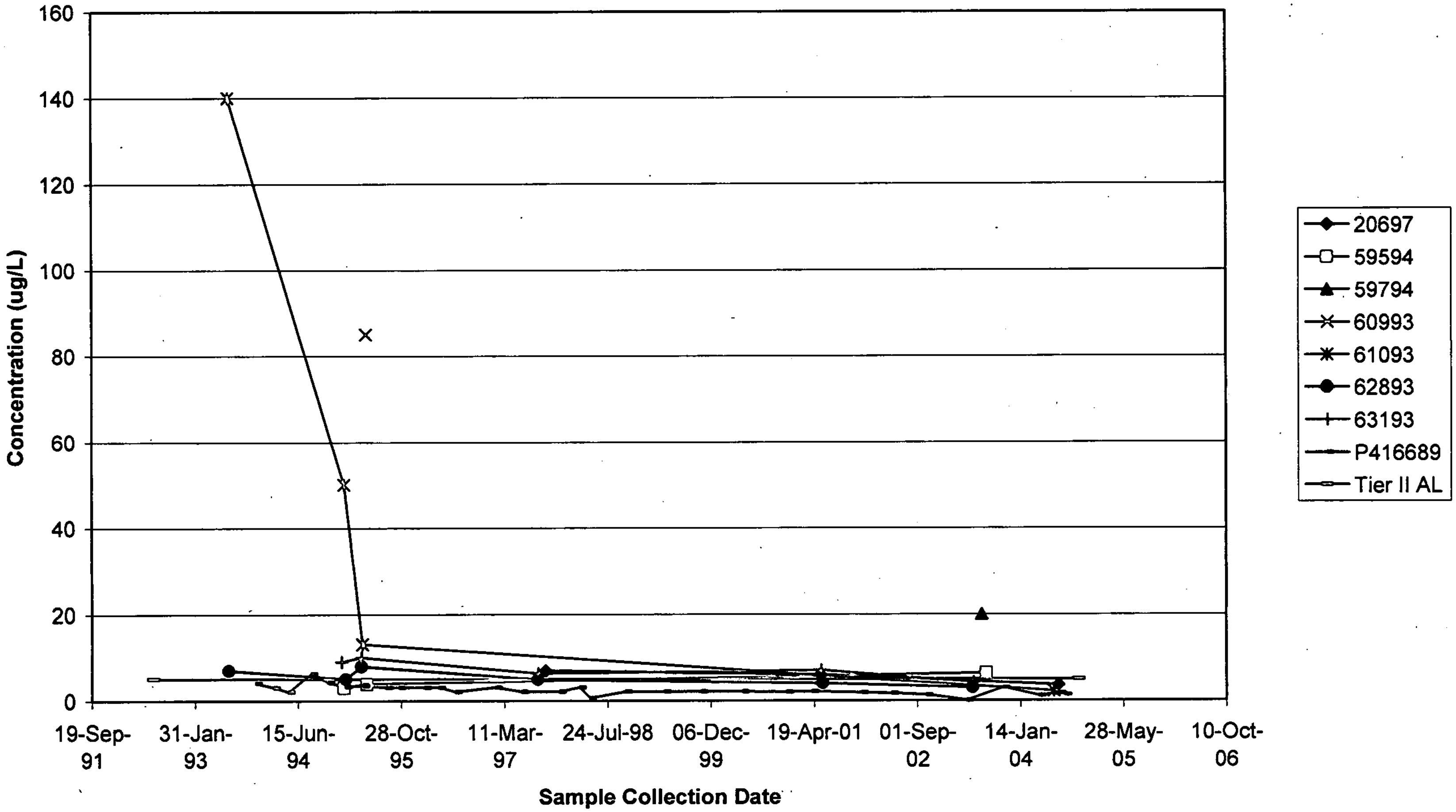


Figure 4-24 Trichloroethene in Groundwater at Wells with a Tier II Exceedance



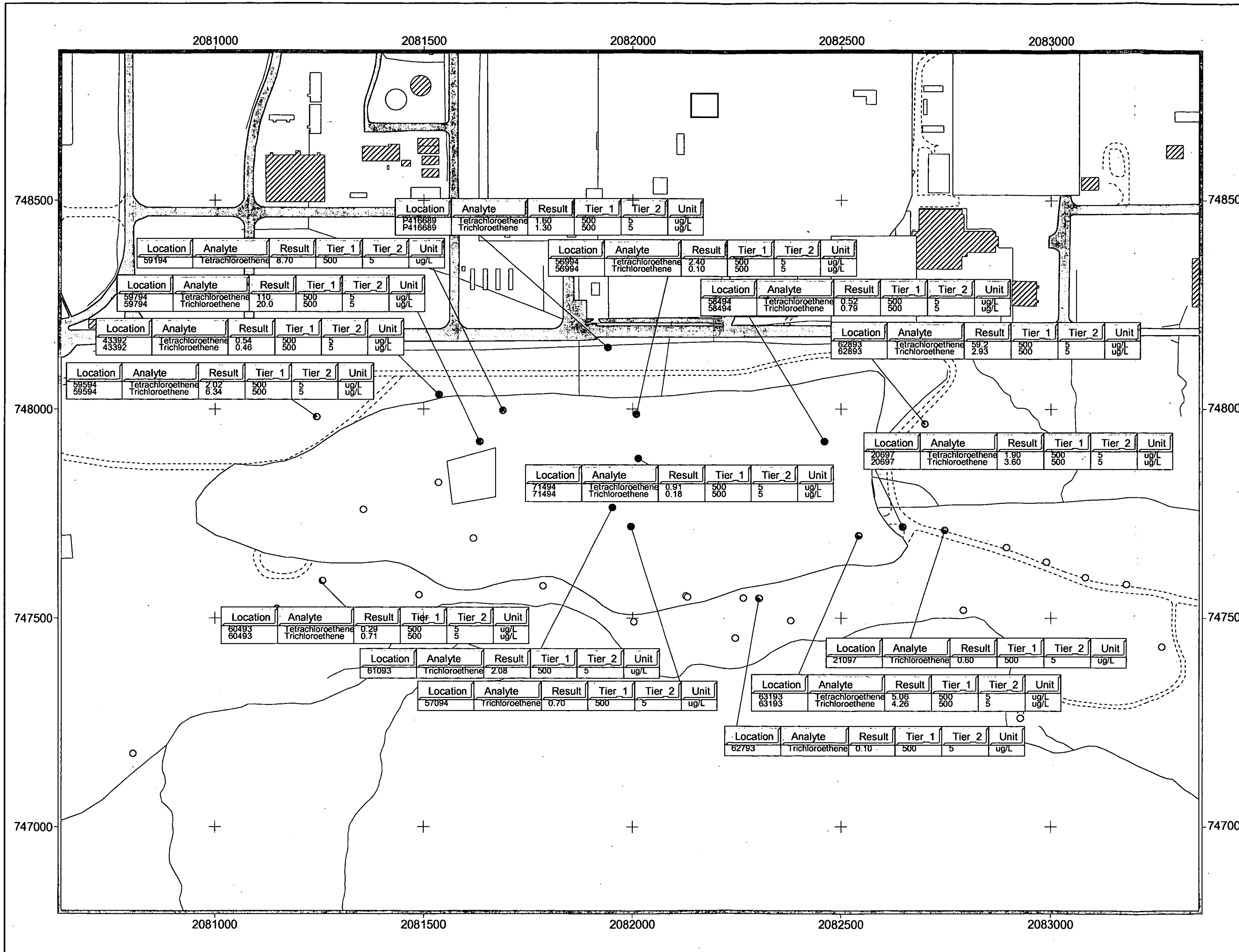


Figure 4-25
Most Recent TCE and PCE Concentrations in Groundwater

KEY

- Tier II Exceedance
- Less than Tier II
- Non-detect
- IHSS
- Paved Road
- Demolished building
- Standing building
- Stream
- Dirt Road

Tier II = 5 ug/L for TCE and PCE
Only detected values are shown

N W E S

200 0 200 Feet

Scale = 1: 2750

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by: Date: 10.06.04
RADMS

Prepared for:
KAISER•HILL COMPANY

File: W:\Projects\Fy2004\original_landfill\AV_Projects\Original_Landfill_NFAA_040804.apr

Figure 4-26 Nitrate Concentrations in Groundwater at Wells with a Tier II Exceedance

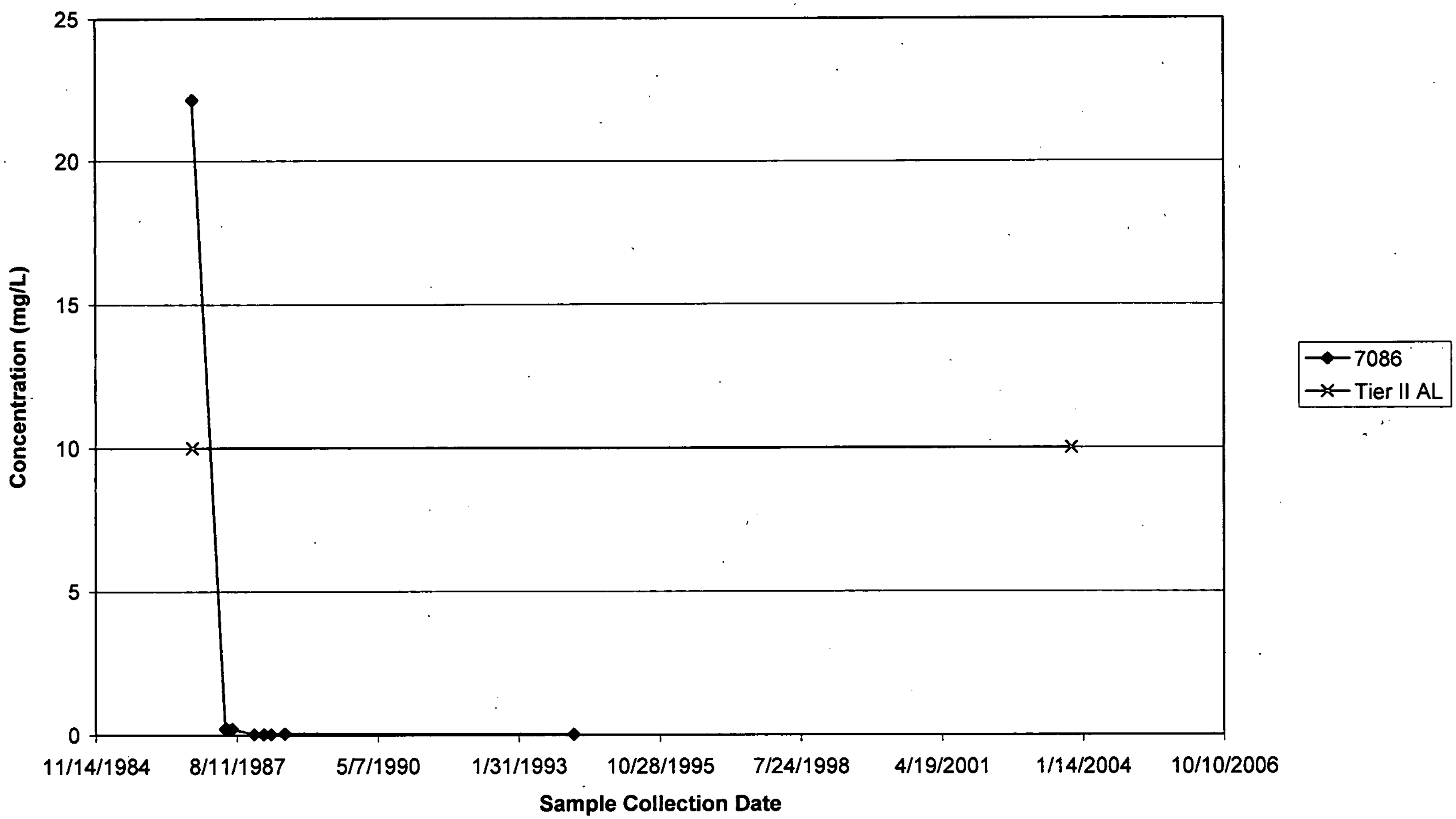
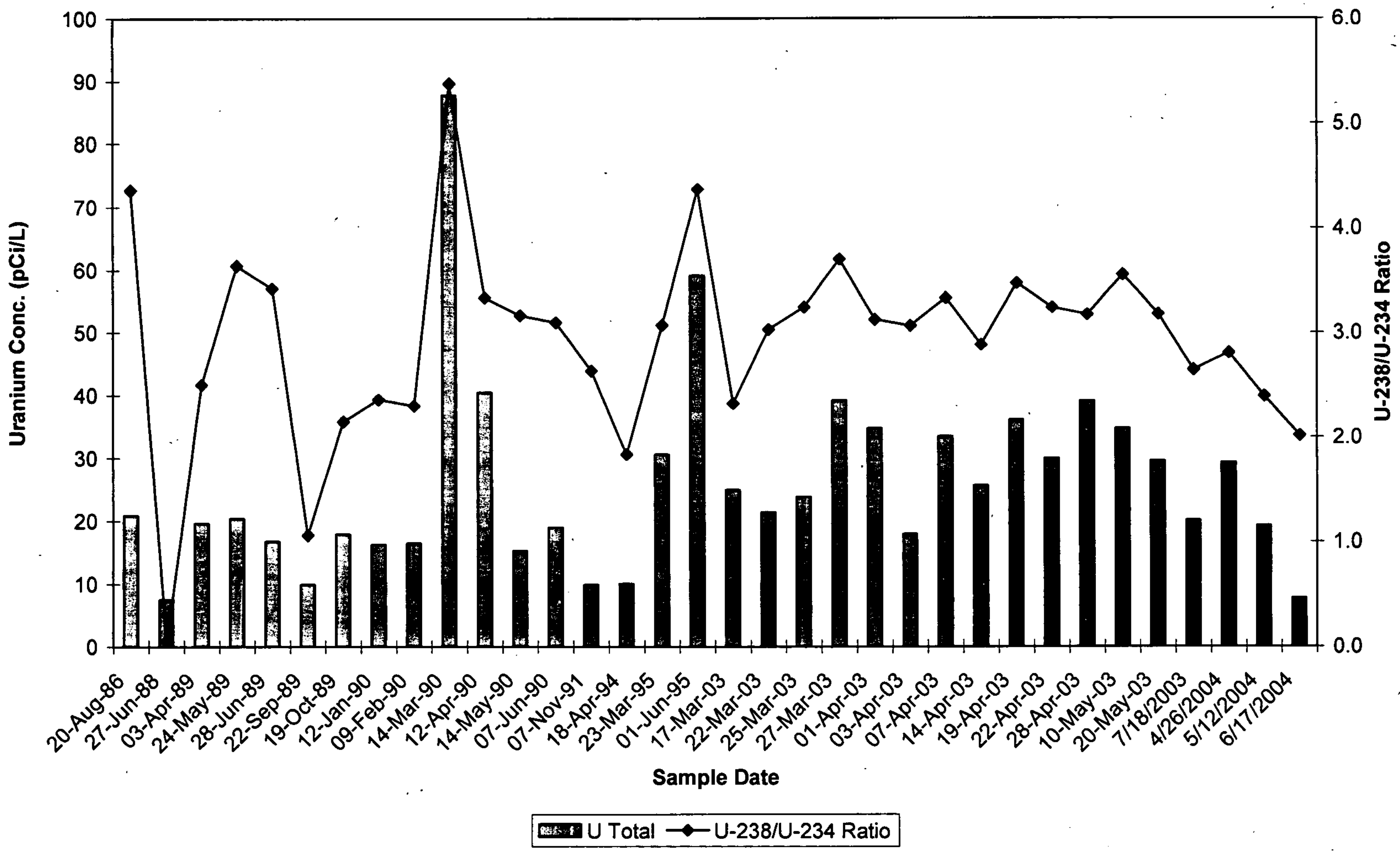


Figure 4-27 Total Uranium Concentrations and Uranium Isotopic Ratios for Surface Water at SW-36



5.0 REMEDIAL ACTION OBJECTIVES

Based upon an evaluation of the OLF operation and associated waste types as well as the risks posed by exposure pathways from the OLF, an accelerated action consistent with the municipal and military landfill presumptive remedy of source containment after hot spot removal (completed in July 2004) is appropriate for the OLF. The streamlining features for evaluating the contamination source and baseline risks posed to human and ecological health afforded by the landfill presumptive remedy directives have been met by conducting the OU 5 Phase I RFI/RI (K-H 1996). However, the information obtained by the investigation and subsequent monitoring substantiates the application of specific source containment components necessary to address the OLF exposure pathways.

Guidance in the *Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills,* OSWER Directive No. 9355.0-67FS, December 1996, was used to evaluate the characteristics of the OLF in relation to those that affect application of the source containment remedy. The following characteristics are consistent with the relevant guidance for the presumptive remedy:

- Risks are low-level, except for uranium surface "hot spots" (uranium surface soil "hot spots" were removed in July 2004, see Appendix C);
- Treatment of waste is impractical due to its volume and heterogeneity of waste; and unnecessary because the OLF presents limited, to no risk to human health and the environment from waste materials exposed at the surface.
- Waste types include household, commercial (for example, construction debris), non-hazardous sludge, and industrial solid wastes (for example, process wastes, VOCs, paints).
- Small amounts of wastes with hazardous constituents were disposed of in the OLF and the amounts are very small compared with a typical municipal waste landfill.

The guidance notes that some military facilities (for example, weapons fabrication and testing) have a high level of industrial activity compared to overall site activities such that there may be a higher proportion and wider distribution of industrial wastes than at less industrialized facilities. The guidance also notes that some wastes specific to military landfills (for example, low-level radioactive wastes) as long as they are not predominant, can be considered low-hazard and no more hazardous than other waste found in municipal landfills. Other military wastes, such as munitions, chemical warfare agents, and chemicals, are high-hazard wastes and require special consideration. These types of wastes were not disposed of in the OLF.

As described in the OU 5 Phase I RFI/RI Report and Sections 2.0 and 4.0 of this IM/IRA, the types of wastes, levels of contamination, and risks posed by the OLF are similar to those deemed appropriate to implement a presumptive source containment remedy. It is also important to note that the OLF has been closed for approximately 35 years with an inadequate soil cover, limited stormwater run-on and runoff controls, and very little maintenance applied, and yet the levels and extent of contamination in environmental media are quite low.

Some surface and subsurface soil samples contained contamination above specific Soil Action Levels in RFETS Action Levels and Standards Framework for Surface Water, Ground Water and Soils, RFCA Attachment 5 (ALF), Table 3, Soil Action Levels. ALF Sections 4.0 and 5.0 require removal of contaminated surface soils to depths specified for non-radioactive and radioactive contaminants. At the OLF, these areas are surface soil "hot spots" that were removed with the approval of the CDPHE, as documented in a RFETS Regulatory Contact Record (see Appendix E).

Deeper soil contaminated above soil action levels must be evaluated in accordance with the ALF Figure 3, *Subsurface Soil Risk Screen* and ALF Section 4.2 and 5.3 to determine whether an action is required. For convenience, ALF Figure 3 is included as Figure 5.1. Because soils action levels are exceeded, the OLF fails Screen 1. Since the OLF lies in an erosion area and the waste and commingled soil have become exposed on the surface, the OLF also fails Screen 2. To be conservative, it is assumed that some subsurface soil may exceed soil action levels for depleted uranium. Given this, it is likely the OLF fails Screen 3. Under Screen 4, it appears the uranium contamination found at SW-036 could be caused at least in part by surface run off into the SID. While this sampling point is not an ALF Section 2 surface water Point of Compliance or Point of Evaluation, an accelerated action evaluated under Screens 2 and 3 should adequately address this potential contaminant source. For Screen 5, the baseline Ecological Risk Assessment for the Woman Creek Priority Drainage discussed in Section 4. 9 of this IM/IRA concluded that there is not an unacceptable risk to ecological receptors. Additional ecological action levels are being developed and ecological risks will be evaluated in the Accelerated Ecological Screening Process and the Comprehensive Risk Assessment.

The OU 5 Phase I RFI/RI concluded that the OLF does not generate hazardous concentrations of landfill gas, thus gas collection or treatment action is not required.

Groundwater at the OLF contains concentrations of some organic compounds and metals, including depleted uranium, greater than background and ALF Table 2, Action Levels for Groundwater. However, this contamination does not generate an expanding plume of groundwater contamination outside of the OLF source area and does not adversely impact surface water quality or present an exposure pathway outside of the OLF source area. In accordance with ALF, Section 3.3.C.2, groundwater plumes that can be shown to be stationary and do not therefore present a risk to surface water, regardless of their contaminant levels, do not require mitigation or management. They do require continued monitoring to demonstrate that they remain stationary. Groundwater at the OLF is not a drinking water source and could not sustain any prolonged use.

Based upon the foregoing evaluation, risks posed by the OLF will be addressed by the proposed accelerated action. The proposed action is to implement "hot spot" removal (completed August 2004) and the presumptive remedy of source containment. There are two pathways of exposure to be addressed by the accelerated action:

- direct exposure to disposed waste and commingled soil; and

- surface erosion and runoff of contaminants into surface water.

Therefore, the Remedial Action Objectives (RAOs) for the OLF are to:

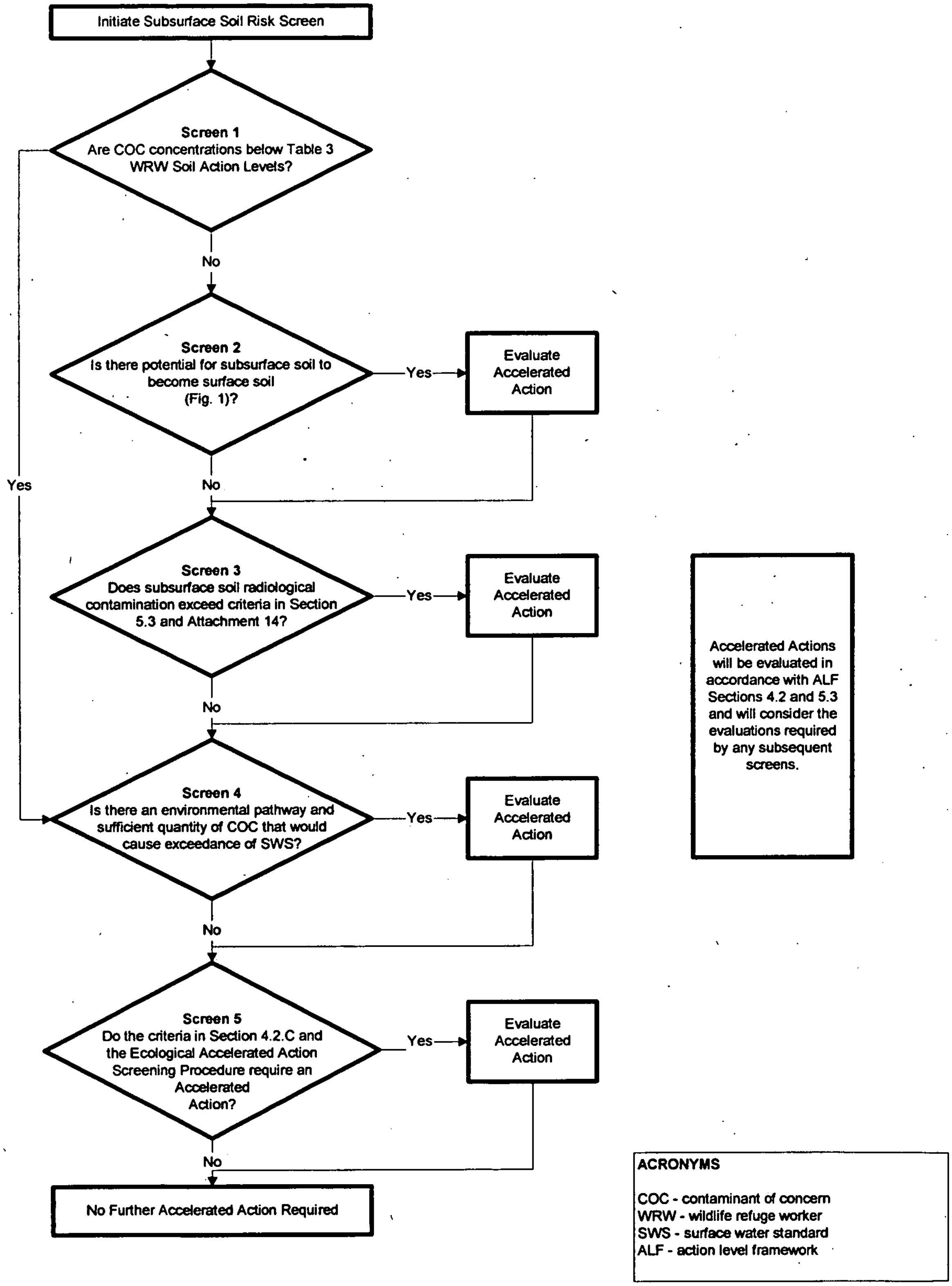
- Prevent direct contact with landfill soil and commingled waste and
- Control erosion caused by Stormwater run-on and runoff.

The components of the source containment remedy that are necessary to address the RAOs are:

- removal of uranium-contaminated surface soils, i.e. "hot spots" (complete in July 2004),
- a stable landfill cover to prevent direct contact with landfill soil or debris;
- a landfill cover that adequately controls erosion caused by stormwater runon and runoff; and
- institutional controls to supplement engineering controls to appropriately monitor and maintain the landfill cover.

In addition to these components, groundwater and surface water monitoring will be conducted. Additional evaluation and a description of the presumptive remedy components and alternatives are presented in Sections 6.0 and 7.0.

Figure 5-1 Subsurface Soil Risk Screen



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Removal of Surface Soil Contaminants

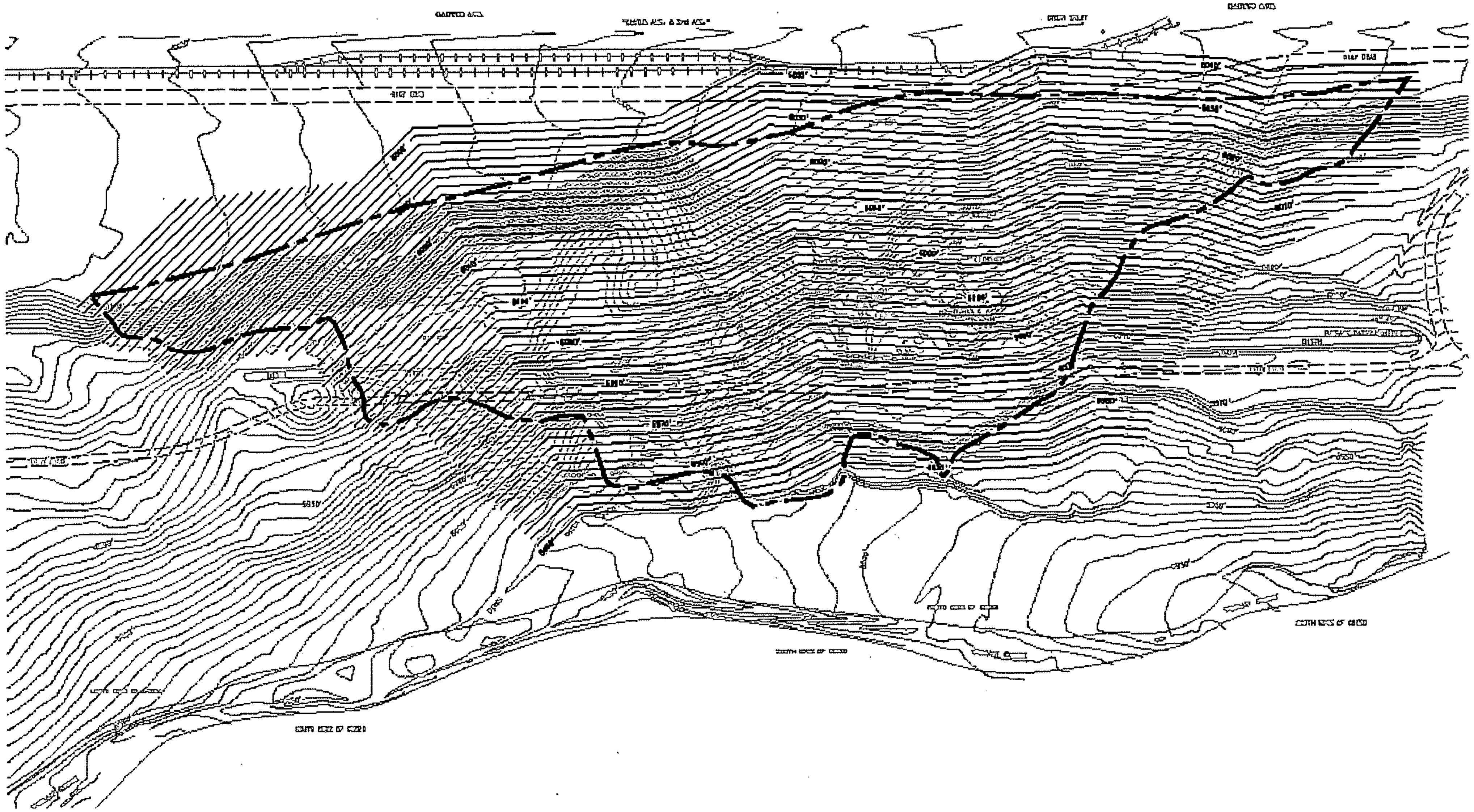
The contaminants exceeding soil action levels are discussed in Section 4.3.

The surface soil hot spots were removed in July 2004. Appendix E describes the removal efforts and presents the confirmation sampling results

Area Grading & Soil Cover

The waste fill area would be graded to generally an 18-percent (5.5:1) slope, or less, using a cut-and-fill approach that would be as balanced as possible. A conceptual grading plan and cross-section are shown on Figures 6-1 and 6-2, respectively. Standard earth-moving equipment, such as dozers, hoes or scrapers, would be used to cut areas where the slope exceeds the desired 18 percent and fill those areas where the slope is less than the desired 18 percent slope. It is estimated that approximately 55,000 cy of waste fill material would be moved during the process and 105,000 cy of fill would be required to reach the 18-percent grade before placing the 2-ft cover.

Figure 6.1
Conceptual Surface Grading Plan



Note: The grading plan will be optimized during the design.

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CH2MHILL

Prepared for:

KAISER-HILL

October 18, 2004

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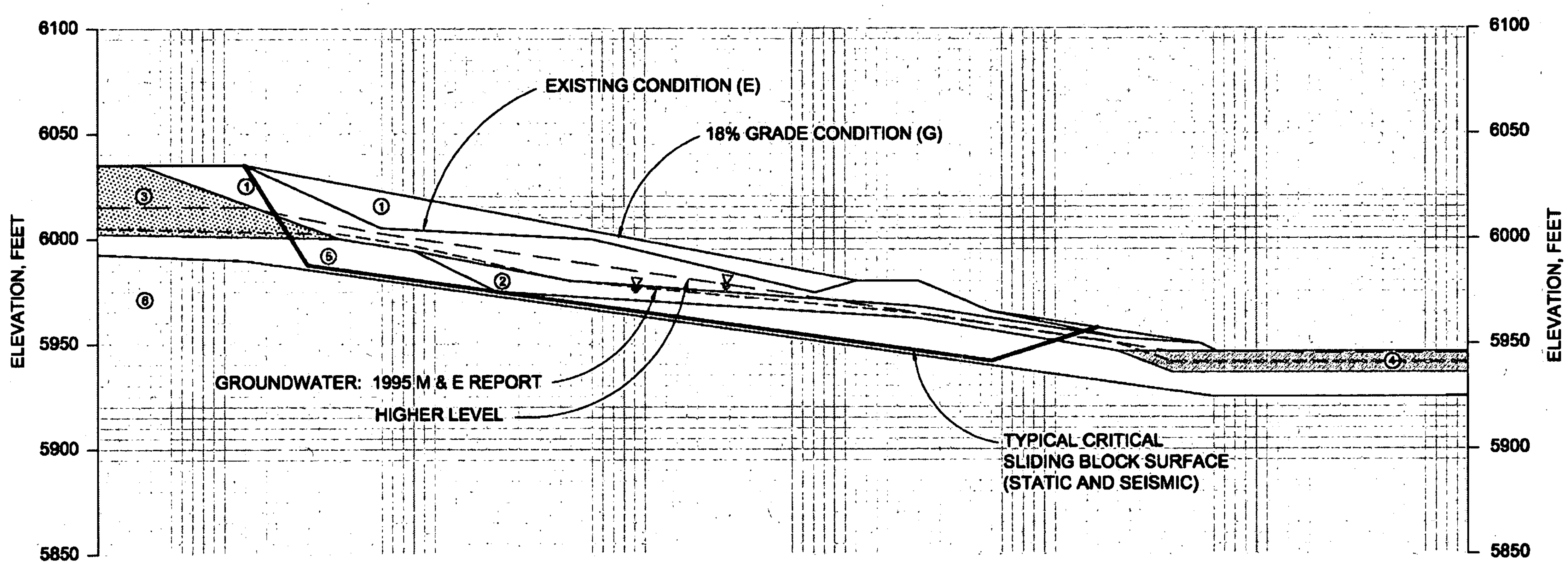
Figure 6.2
Typical Conceptual Cross - Section of Landfill Graded Surface



Note: The grading plan will be optimized during the design.

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Control measures would be implemented during the grading process to control the spread and release of waste materials in the OLF. The control measures would include the establishment of work zones, decontamination procedures, dust suppression methods, traction mats, visual inspections, and radiological surveys. Work would be suspended when environmental conditions could greatly increase the possibility of the spread of contaminated materials. Monitoring would be performed, as necessary, to verify that there has been no release of contaminated materials.

After the grading of the landfill surface is complete, a soil cover will be placed over the landfill to a minimum thickness of 2 ft. About 65,000 cubic yards of local or onsite soil will be used to construct the cover. The soil cover will be compacted sufficiently to provide a stable cover system to promote surface water runoff, reduce surface water ponding, increase overall slope stability, and provide a suitable soil surface for revegetation.

Revegetation of the soil cover with native species will reduce erosion. The seeding will be conducted, along with erosion control matting or mulch to prevent erosion of the cover while allowing the vegetation to establish a strong stand.

Institutional Controls

Post-accelerated action institutional controls will be implemented. These controls consist of access controls, continued DOE jurisdiction, and controls to prevent drilling, excavation, or disruption of the cover or sampling stations. Routine monitoring and inspection of implemented controls will be performed.

6.1.3 Alternative 3 – Soil Cover With Buttress Fill

All the components of Alternative 2 (Section 6.1.2) are included in Alternative 3. Additional features of Alternative 3 include the construction of a buttress fill at the toe of the regraded surface of the OLF and the possible construction of an upgradient groundwater "cutoff" wall immediately north of the OLF.

Buttress Fill

A structural soil fill would be built at the toe of the OLF regraded surface as conceptually depicted on Figure 6-3. The buttress fill would be either placed on top of the weathered bedrock or just beneath the weathered bedrock on top of the unweathered bedrock. The buttress fill would be built by placing specified structural fill soil in loose lifts and compacting the lifts to a desired relative compaction requirement.

If it was determined during the design of the buttress fill that the buttress would be placed through the weathered bedrock on top of the unweathered bedrock, trench boxes or other structural support methods could be required to allow excavation of the weathered bedrock. These special construction provisions would be needed to prevent movement of the waste fill above the weathered bedrock excavation into the buttress construction area.

A rock layer and strip drains would be placed under and upgradient of the buttress fill to reduce and control the hydraulic head behind the buttress fill. These drainage layers are needed to prevent water saturation of the fill soil and eliminate any seepage flow through or around the buttress fill.

Upgradient Groundwater "Cut-off" Wall

An upgradient groundwater "cut-off" wall was be considered with this alternative to further control the lateral inflow of groundwater into the OLF. A wall for this purpose would be constructed of a soil/bentonite type slurry keyed into the weathered bedrock. However, the groundwater modeling indicates that the impact on groundwater levels in the OLF from the construction of such a wall would be very minimal and on the order of less than 3 ft. Therefore, a groundwater "cut-off" wall is not included in Alternative 3.

6.1.4 Alternative 4 – Removal of Waste

The objective of this alternative is to remove the entire waste fill from within the OLF area and restore the hill slope. The remedial measures would consist of the following five activities:

- Preparation of the site;
- Excavation of contaminated debris and soil;
- Characterization and segregation of waste fill debris and soil;
- Off-site disposal of waste fill debris and contaminated soil; and
- Restoration of disturbed areas.
- It is estimated that approximately 192,000 cubic yards (bulking of 160,000 cubic yards of commingled soil) of waste fill debris and soil would be excavated, characterized, and transported to an off-site, licensed disposal facility. The volumes of radioactive and nonradioactive contamination in the waste fill are currently unknown, but would be determined during implementation. These remedial measures would be completed in approximately 3 years. Specific activities to implement this alternative are described below.

Site Preparation

Prior to excavation of the waste fill debris and soil, the site would be prepared. First, access roads and storage areas would be constructed. Second, the area to be excavated would be cleared and grubbed, and surface water control features would be constructed. The procedures used to complete these tasks are described below.

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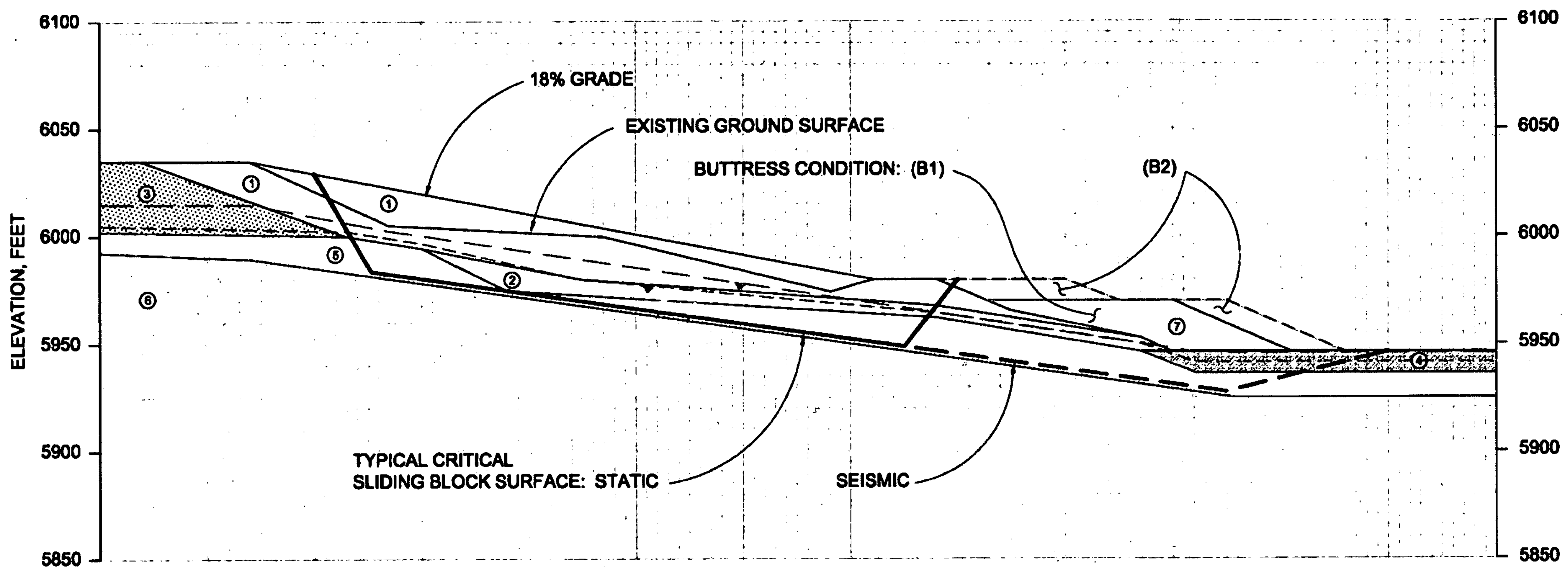

Figure 6.3 Typical Conceptual Cross - Section of Regraded Landfill Surface with a Buttress fill

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Construction of Storage Areas and Access Roads

A storage area would be located north of the OLF boundary. It is estimated that three to four acres would be required to accommodate the required equipment, supplies, and construction offices to stage and characterize the removed waste materials and soil.

In addition, this alternative would require the construction of three new access roads. The first new access road would be constructed to connect the existing access road that runs east-west through the center of the OLF to the waste fill area located in the northeastern section of the landfill. The second new access road would be located south of the OLF boundary to connect the existing access road to the waste fill area located in the southern section of the landfill. The third new access road would be located on the western edge of the OLF boundary to connect the existing access road to the stockpile area. The combined length of these new access roads would be approximately 2,000 ft. The maximum grade of the new roads would not exceed 7 percent, and the design would allow for drainage of surface water while the roads were in use.

Clearing, Grubbing, and Stockpiling

A stockpile area would be located on the terrace immediately northwest of the IHSS boundary. It would be approximately two acres in size and would accommodate up to 20,000 cubic yards of waste fill material at any given time during the project.

The area within the OLF boundary would be cleared and grubbed of vegetation, debris, loose rocks, and other items that would interfere with the waste fill removal process. The cleared materials would be transported to the stockpile area for characterization prior to disposal. Surface water would be directed around the stockpile and excavated areas.

Excavation of Contaminated Waste Fill Debris and Soil

The area that would be excavated is shown on Figure 1-2. The waste fill within this area would be stripped and placed into temporary stockpiles using standard equipment, such as crawler-type dozers, track-type loaders, and track-mounted excavators. The machines utilized would be small enough to ensure a high degree of cut accuracy and a minimum amount of over excavation. Trucks or large-capacity wheel loaders would be used to move the waste fill from temporary stockpiles to the primary stockpile area located immediately northwest of the OLF boundary.

Excavated areas would be carefully inspected visually and with field instrumentation to determine the outer limits of the waste fill area. Confirmation sampling and analysis would be then conducted to verify that radioactive and nonradioactive waste materials have been adequately removed.

Characterization of Waste Fill Debris and Soil

The waste fill material removed from the OLF during the grubbing and excavation processes would be characterized at the stockpile area using a two-step process. First, field screening techniques would be used to determine the characteristics of the stockpiled materials. Second, samples would be collected and analyzed to determine if the material is a characteristic RCRA

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hazardous waste. Potential hazardous waste would be further characterized using the Environmental Protection Agency (EPA) TCLP analysis.

Disposal of Waste Fill Debris and Soil

Following characterization, each pile of waste fill material would be classified for disposal. Items determined to be radiologically contaminated or that exhibit a toxicity characteristic would be transported to an appropriately licensed facility for final disposal. Items determined not to be radiologically contaminated or that do not exhibit a toxicity characteristic would be managed as solid waste. Waste material classified as solid waste and meeting disposal facility waste acceptance criteria would be disposed of at a local sanitary landfill.

Restoration of Disturbed Areas

Following completion of remediation activities, the disturbed areas would be reclaimed. This process would require some grading and backfilling of the area prior to seeding and revegetation. The seeding and revegetation process would be the same as described in Section 6.1.2.

6.2 COMPARATIVE EVALUATION OF ALTERNATIVES

This section provides a comparative evaluation of the remedial alternatives using the criteria of effectiveness, implementability, slope stability, and relative cost. A summary of the comparative evaluation is provided in Table 6-1.

The relative cost estimates provided in this report are preliminary, and are provided primarily for the purpose of comparing the various remedial action alternatives. The final actual costs of a remedial alternative will depend upon the labor and material costs, site conditions, productivity, and competitive market conditions for contractors at the time of implementation, as well as the final project scope, final project schedule, final engineering design, and other variable factors. As a result of these uncertainties, the final costs will vary from the estimates provided herein.

Estimated costs of the alternatives include indirect capital costs, direct capital costs, and annual costs. Estimated costs were prepared utilizing estimated volumes, vendor quotes, available literature, Means Cost Data guides (R.S. Means Company 2001), and other sources deemed appropriate. Estimated costs are presented in Appendix F.

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Table 6-1
Summary of Comparative Evaluation of Potential Remedial Alternatives

Criteria	Alternative 1 No Action	Alternative 2 Limited Grading & Soil Cover	Alternative 3 Limited Grading, Soil Cover & Buttress Fill	Alternative 4 Removal with Off-Site Disposal
Effectiveness	**Low**	**Moderate**	**Moderate**	**High**
Protection of Public Health and Environment	Current wastes remain exposed and potential erosion continues; however, OLF currently exhibits limited to no impact on public health and the environment.	Exposed wastes are covered and further slope erosion is eliminated to exposed wastes in the future.	Exposed wastes are covered and further slope erosion is eliminated to exposed wastes in the future. Buttress fill provides some increase in overall slope stability but impacts more of the PMJM habitat and wetlands areas	All waste removed from area.
Compliance with ARARs	Complies with all ARARs except those relative to the landfill cover	Complies with all ARARs	Complies with all ARARs	Complies with all ARARs. Compliance with waste management requirements for treatment and disposal may prove difficult or impracticable for some wastes.
Long-Term Effectiveness and Permanence	Some waste remains exposed.	Proven technologies over the long term implemented.	Proven technologies over the long term implemented.	Removes all waste from the area.
Short-Term Effectiveness	Low due to exposed waste; however, PMJM and wetlands would not be affected.	Moderate to High short-term effectiveness since risks associated with some limited movement of waste materials. PMJM and wetlands mitigation required.	Possible additional risk to workers during construction of buttress fill. Additional PMJM and wetlands mitigation required.	Low short-term effectiveness due to the potential to release contamination from the excavation and movement of waste materials. PMJM and wetlands mitigation required.
Compliance with Remedial Action Objectives	Would not comply RAOs.	Will comply with RAOs.	Will comply with RAOs.	Will comply with RAOs.
Implementability	**High**	**Moderate/High**	**Moderate/Low**	**Low**
Technical Feasibility	Technically feasible	Technically feasible	Technically feasible	Technically feasible
Maintenance and Monitoring Requirements	Annual inspection, maintenance, and repair on as-needed basis	Periodic inspection, maintenance, and repair on as-needed basis	Periodic inspection, maintenance, and repair on as-needed basis	No maintenance or monitoring required
Construction Feasibility	Construction is feasible	Construction is feasible	Construction feasible, but more difficult.	Construction is feasible but much more difficult and time consuming
Availability of Services and Materials	All materials locally available	All materials locally available	All materials locally available	Disposal facilities available in U.S
Administrative Feasibility	Not administratively feasible	Administratively feasible	Administratively feasible	Administratively feasible
Stability	**Moderate**	**High**	**High**	**Moderate**
Static Factor of Safety	1.3 – 1.5	1.5 – 1.7	1.7 – 1.9	Not applicable
Seismic Factor of Safety	0.7 – 0.8	0.9	0.9 – 1.0	Not applicable
Estimated Deformation	10" – 12"	5" – 10"	3" – 5"	Not applicable
Capital Cost*	**$50, 000 to $60,000**	**$4.0 MM to $4.6 MM**	**$6.0 MM to $6.9 MM**	**$100 MM to 260 MM**
O&M Cost ($/yr)	**$25,000**	**$31,000**	**$31,000**	**$0**
Present Worth Cost**	**$800,000 to $810,000**	**$4.93 MM to 5.53 MM**	**$6.93 MM to $7.83 MM**	**$100 MM to 260 MM**
Regulatory/ Community Acceptance	**Low**	**Low**	**High**	**Moderate**

* Costs are in 2004 dollars.
** Assumes 30 years of O&M without an escalation factor

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6.2.1 Alternative 1 – No Action

This alternative, as presented in Section 6.1.1, consists of only institutional controls and monitoring.

Effectiveness

Effectiveness considers whether the alternative provides protection of human health and the environment, and achieves the remedial objectives.

Protectiveness

The No Action Alternative would leave the waste in place as it exists today and allow for potential release of contaminants; however, as presented in Section 4.0, the OLF currently exhibits limited to no impact on human health and the environment. Alternative 1 would attain all Applicable and Relevant and Appropriate Requirements (ARARs), except those relative to the landfill cover. Institutional controls, such as signs and other barriers would help to reduce human exposure to the waste materials. However, wildlife workers and trespassers may occasionally enter the area and could potentially come in contact with the OLF debris.

In the short term, there would be low risks to the workers and public during the implementation of this alternative, and no impact on the Preble's Meadow Jumping Mouse habitat south of the OLF or to wetlands within the OLF.

Alternative 1 is not considered effective in the long term. Potential exposure to OLF debris and continued surface erosion would remain; however, as presented in Section 4.0, the OLF currently exhibits limited to no impact on human health and the environment. Alternative 1 would continue to provide existing habitat for the PMJM without disruption, and would not disturb or destroy the wetlands at the OLF. Institutional controls and monitoring would provide for some continuing protection.

Achieve Remedial Objectives

Alternative 1 would not comply with the RAOs of preventing direct contact with the landfill waste or controlling the existing surface erosion patterns. However, as presented in Section 4.0, the OLF currently exhibits limited to no impact on human health and the environment.

Implementability

Implementability addresses the technical and administrative feasibility of implementing an alternative using the required equipment, services, and materials.

Technical Feasibility

Alternative 1 is technically feasible because no construction activities would be required except for the fabrication and installation of signs and possibly barriers. With this limited construction, the PMJM habitat and wetlands would remain undisturbed. However, Alternative 1 would provide monitoring of the long-term physical features

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of the OLF to identify any detrimental changes. Maintenance of the institutional controls implemented would be considered minimal.

Availability

Alternative 1 would only require materials for signs and possibly barriers to implement institutional controls. These materials are readily available. Monitoring would use industry standard equipment and materials that are also readily available.

Administrative Feasibility

The implementation of Alternative 1 does not require permits or easements, and does not impact adjoining property. It will not inhibit the ability to impose institutional controls. Existing site management and access controls would be maintained until a comprehensive final plan is implemented in the future. The alternative is generally consistent with the aesthetic qualities of the facility end use as a wildlife refuge.

Alternative 1 would most likely not meet CDPHE, EPA, and community acceptance because debris is left exposed at the surface of the OLF and surface erosion would most likely continue.

Cost

Evaluation of costs should consider the capital costs to engineer, procure, and construct the required equipment and facilities, and the operating and maintenance costs associated with the alternative.

Capital Cost

The capital cost to implement Alternative 1 is between $50,000 and $60,000.

Operation & Maintenance Cost

The operation and maintenance costs associated with this alternative involve inspection of the OLF surface and maintenance of the groundwater and surface water monitoring stations. Sampling and analysis of groundwater and surface water is also included. Operation and maintenance costs are estimated to be approximately $25,000 per year; however, additional costs could be incurred to address any hazards exhibited by the wastes continuing to be exposed.

Summary – Alternative 1

Alternative 1 was not retained for further consideration because the OLF debris remains exposed and potential surface erosion would continue. The OLF currently exhibits little to no impact on human health and the environment.

6.2.2 Alternative 2 – Soil Cover

Alternative 2, Soil Cover is presented in Section 6.1.2 and generally includes the removal of radiologically contaminated surface soil (completed in July 2004), limited site grading, placement of a 2-ft-thick soil cover, and revegetation of the soil cover.

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Effectiveness

Effectiveness considers whether the alternative provides protection of human health and the environment, and achieves the remedial objectives.

Protectiveness

Alternative 2 would provide a higher overall level of protection than Alternative 1 because the waste would be covered, eliminating direct contact with the OLF debris. The radiologically contaminated soil has already been removed. Alternative 2 would comply with ARARs. The stabilization of the hillside would add additional long-term protection of the waste fill area by reducing the possibility of movement and erosion. Potential remediation worker exposure would be higher during implementation of Alternative 2 than during Alternative 1 because of the movement of waste during the regrading operations. However, appropriate safety measures will be employed to protect the worker during construction.

The regraded surface provides for a more stable configuration. Static factors of safety[8] are estimated to be from 1.5 at "wet-year" groundwater levels to 2.2 during "dry-year" conditions. Also, the seismic factors of safety are estimated at 1.0 to 1.2 with a possible corresponding deformation range of 9 to 6 inches. The seismic calculations assume a 0.12 (Xg, gravity) peak acceleration coefficient, which has a 2-percent probability of occurring every 50 years (EarthTech 2004).

Alternative 2 would have low to moderate short-term effectiveness. This alternative has a chance of impacting workers, the public, and the environment during implementation. Most of the potential health impacts would be due to potential inhalation of fugitive dust and the ingestion of dust and contaminated materials (hand to mouth). However, health and safety controls would be readily implemented to protect workers and the public. A site-specific Health and Safety Plan (HASP) would be developed for the site that addresses worker safety including dust monitoring, decontamination procedures, etc. Also, engineering controls, such as the addition of water to disturbed areas, would be implemented to control dust. During the implementation of these alternatives, there would also be the potential for short-term impacts to the environment due to spills, dust, and surface runoff from disturbed areas. These impacts would be readily controlled through appropriate transportation and engineering practices, such as covering of loads, onsite spill cleanup, dust control measures, erosion protection, silt fences, etc. In addition, construction activities would remove some jurisdictional and candidate wetlands and a portion of the PMJM protection area within the boundary of the OLF.

Alternative 2 will provide a long-term cover over the currently exposed OLF debris and eliminate the current erosional conditions. However, because the OLF (as presented in Section 4.0) currently exhibits limited to no impact on human health and the environment, Alternative 2 provides containment of the OLF materials consistent with the presumptive remedy discussed in Section 1.1. Alternative 2 would rely upon proven technologies for slope stabilization and landfill covering. Infiltration of

[8] The factor of safety is the ratio of the force resisting movement to the force causing movement.

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surface water would be reduced through installation of a soil cover with a consistent grade.

Achieve Remedial Objectives

Alternative 2 will meet all of the remedial action objectives. The Landfill will be covered with an appropriately designed soil cover to prevent contact with the waste materials. Construction activities will remove wetlands and a portion of the PMJM protection area within the boundary of the OLF; however, the PMJM habitat would return after construction of the action.

Implementability

Implementability addresses the technical and administrative feasibility of implementing an alternative using the required equipment, services, and materials.

Technical Feasibility

Alternative 2 is technically feasible using proven controls and engineering design features that have been successfully implemented at other sites with similar conditions. All controls within the alternative could be executed using readily available machinery, including earthmoving equipment, haul trucks, and other conventional construction equipment.

Alternative 2 will require maintenance of the cover through routine inspections and repair as needed. Monitoring of groundwater and surface water would be required; however, the requirements would be slightly less than for Alternative 1 because of the containment provided by Alternative 2.

Availability

For Alternative 2 mainly natural materials are required. The cover materials would either come from an on-site borrow source, or a borrow source close to the site. Monitoring would use industry standard equipment and materials that are also readily available.

Administrative Feasibility

The implementation of Alternative 2 does not require permits or easements, and does not impact adjoining property. It will not inhibit the ability to impose institutional controls. Existing site management and access controls would be maintained until a comprehensive final plan is implemented in the future. The alternative is consistent with the aesthetic qualities of the facility end use as a wildlife refuge.

Alternative 2 will remove jurisdictional wetlands and a portion of the PMJM protection area.

Alternative 2 could gain CDPHE, EPA, and community acceptance.

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<u>**Cost**</u>

Evaluation of costs should consider the capital costs to engineer, procure and construct the required equipment and facilities, and the operating and maintenance costs associated with the alternative.

Capital Cost

The capital cost to implement Alternative 2 is between $4,000,000 and $4,600,000.

Operation & Maintenance Cost

The operation and maintenance costs associated with this alternative involve inspection and maintenance of the cover. Other monitoring costs, such as groundwater and surface water monitoring would also be included. Operation and maintenance costs are estimated to be $31,000 per year.

Summary – Alternative 2

Alternative 2 implements the presumptive remedy, meets all of the remedial action objectives and attains the ARARs.

6.2.3 Alternative 3 – Soil Cover with Buttress Fill

Alternative 3, Soil Cover with a buttress fill is presented in Section 6.1.3 and generally includes the removal of radiologically contaminated surface soil (completed in July 2004), limited site grading, placement of a 2-ft-thick soil cover, revegetation of the soil cover, and installation of a buttress fill at the toe of the regraded slope.

<u>**Effectiveness**</u>

Effectiveness considers whether the alternative provides protection of human health and the environment, and achieves the remedial objectives.

Protectiveness

Alternative 3 provides the same degree of overall protection as Alternative 2 because the waste would be covered to prevent direct contact. Alternative 3 would comply with ARARs. Construction of the buttress fill would only slightly add additional long-term protection of the waste fill area by reducing the possibility of movement (see Table 6.1). Potential worker exposure to radioactively and nonradioactively contaminated substances would be higher during implementation of Alternative 3 than during Alternative 2 because of the excavation of soil and possibly the weathered bedrock to allow construction of the buttress.

Alternative 3 would provide a slightly higher level of long-term effectiveness because the stability of the OLF coupled with the stability of an appropriately designed soil cover the buttress would increase slightly. Alternative 3 would rely upon proven technologies for slope stabilization and landfill covering. Although unlikely, plugging of the buttress drains could lower the stability of the buttress by saturating the buttress soil and increasing the water levels.

Alternative 3 would have lower short-term effectiveness than Alternative 2. This alternative has a greater chance of impacting workers, the public, and the environment during implementation. Greater potential health impacts would be due to creating more potential inhalation of fugitive dust and the ingestion of dust and contaminated materials (hand to mouth) and the risks associated with construction of the buttress (more heavy equipment and truck traffic). However, health and safety controls would be readily implemented to reduce the risk to workers and the public. In addition, construction of Alternative 3 would remove more jurisdictional and candidate wetlands and PMJM protection area than Alternative 2, and prevent the growth of PMJM habitats up the landfill slope.

Achieve Remedial Objectives

Alternative 3 would meet all of the remedial action objectives. The Landfill would be covered with an appropriately designed soil cover to prevent contact with the waste materials. However, construction activities will permanently remove wetlands and a portion of the PMJM protection area within the boundary of the OLF.

Implementability

Implementability addresses the technical and administrative feasibility of implementing an alternative using the required equipment, services, and materials.

Technical Feasibility

Alternative 3 is technically feasible using proven controls and engineering design features that have been successfully implemented at other sites with similar conditions; however, the buttress fill is more difficult to build than the components of Alternative 2. Construction of the buttress may require trench boxes or special shoring to prevent movement of soil and waste materials into the buttress excavation. All controls within the alternative could be executed using readily available machinery, including earthmoving equipment, haul trucks, and other conventional construction equipment.

Alternative 3 would require more maintenance and inspections than Alternative 2 because of the added component buttress fill. Monitoring of groundwater and surface water would be required, just like Alternative 2.

Availability

For Alternative 3 mainly natural materials are required; however, more material will be required than for Alternative 2. The materials would either come from an on-site borrow source, or a borrow source close to the site. Monitoring would use industry standard equipment and materials that are also readily available.

Administrative Feasibility

The implementation of Alternative 3 does not require permits or easements, and does not impact adjoining property. It will not inhibit the ability to impose institutional controls. Existing site management and access controls would be maintained until a comprehensive final plan is implemented in the future. The alternative is consistent with the aesthetic qualities of the facility end use as a wildlife refuge; however, the migration of PMJM habitat north of the buttress would be seriously slowed or eliminated.

Alternative 3 would permanently remove jurisdictional wetlands and PMJM protection area.

Alternative 3 would most likely gain CDPHE, EPA, and community acceptance more readily than Alternative 2.

Cost

Evaluation of costs should consider the capital costs to engineer, procure and construct the required equipment and facilities, and the operating and maintenance costs associated with the alternative.

Capital Cost

The capital cost to implement Alternative 3 is between $6,000,000 and $6,900,000.

Operation & Maintenance Cost

The operation and maintenance costs associated with this alternative involve inspection and maintenance of the cover. Other monitoring costs, such as groundwater and surface water monitoring would also be included. Operation and maintenance costs are estimated to be $31,000 per year.

Summary – Alternative 3

Alternative 3 does not significantly provide for greater protection of the public and environment than Alternative 2 and exhibits greater short-term and long-term impacts to the ecological environment. Alternative 3 may increase the risk of worker injury over that of Alternative 2 with the additional construction materials and operation of heavy construction equipment. However, Alternative 3 does exhibit slightly higher stability factors of safety and, based on discussions with the regulators and stakeholders, has been selected as the proposed accelerated action.

6.2.4 Alternative 4 – Removal with Offsite Disposal

Alternative 4, Removal with offsite disposal is presented in 6.1.3 and generally includes the removal of radiologically contaminated surface soil (completed in July 2004), the removal and disposal of all OLF wastes and contaminated soil, and grading of the area to a stable configuration.

Effectiveness

Effectiveness considers whether the alternative provides protection of human health and the environment, and achieves the remedial objectives.

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Protectiveness

Alternative 4 would provide the highest level of long-term effectiveness, because all waste materials would be removed permanently from the OLF area. Alternative 4 would rely upon proven techniques for waste excavation, classification, and disposal.

Under Alternative 4, material removed from the OLF will require characterization for disposal in an appropriately licensed facility. However, prior to disposal, the waste may need to be treated to meet Land Disposal Restriction (LDR) standards or other standards required by the disposal facility. The types of treatment required would be identified during design and implementation. Alternative 4 would comply with ARARs, although compliance with waste management requirements for treatment and disposal may prove difficult or impractical for some wastes. This could lead to the need for waste storage at RFETS pending final waste disposition.

Alternative 4 will have a high short-term effectiveness due to the exposure of the workers to waste during implementation and the potential for an off-site release due to transportation accidents. This alternative will also temporarily damage jurisdictional and candidate wetlands within the boundary of the OLF. Wetlands and PMJM habitat mitigation may be required.

Achieve Remedial Objectives

Alternative 4 will meet all of the remedial action objectives because all the waste materials would be removed from the site for disposal in off-site licensed facilities. Construction activities will damage jurisdictional wetlands and a portion of the PMJM protection area within the boundary of the OLF. However, these habitats will likely recover.

Implementability

Implementability addresses the technical and administrative feasibility of implementing an alternative using the required equipment, services, and materials.

Technical Feasibility

Alternative 4 is technically feasible using only proven controls that have been successfully implemented at other sites with similar conditions. All controls within the alternative could be executed using readily available machinery including earthmoving equipment, haul trucks, and other conventional construction equipment. However, the handling, segregation, sampling, treatment, and disposal processes for this alternative are technically challenging and will require additional operational and safety procedures for successful implementation.

Off-site disposal included in the alternative would be technically feasible, because disposal facilities have been identified by RFETS and have been used for waste disposal in the past. However, this alternative may require waste storage pending disposition of some wastes at off-site disposal facilities.

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Alternative 4 is the only alternative that does not require post action maintenance or monitoring by RFETS. The commercial disposal facility chosen would be responsible for all monitoring and maintenance of the disposed waste.

Availability

Required goods and services for implementation of the alternative are reasonably available, although treatment may be costly and impractical for some wastes. It is anticipated that the contractors, labor, equipment, and most of the materials would come from the Denver/Front Range area, which surrounds the site.

Off-site disposal facilities are established for hazardous and radioactive waste generated at RFETS. Solid waste would be disposed of in a nearby State-permitted solid waste facility. Off-site RCRA hazardous waste and low-level hazardous waste would be disposed at appropriate facilities (for example, NTS and/or Envirocare of Utah).

Administrative Feasibility

The implementation of Alternative 4 does not require permits or easements, and does not impact adjoining property. It will not inhibit the ability to impose institutional controls. Existing site management and access controls would be maintained until a comprehensive final plan is implemented in the future. The alternative is generally consistent with the aesthetic qualities of the facility end use as a wildlife refuge.

This alternative will temporarily damage jurisdictional wetlands and a portion of the PMJM protection area. Therefore, formal consultation with the USFWS would be required for potential PMJM impacts.

Alternative 4 is administratively feasible; however, is the most complex alternative because all waste will be removed from the OLF area and disposed of off site. Typical safety concerns with the transportation of radioactive and nonradioactive contamination from the site would be expected. However, transportation of similar waste from RFETS is routine and is unlikely to cause public concern. Appropriate safety measures would be implemented to protect the public during waste transportation.

Cost

Evaluation of costs should consider the capital costs to engineer, procure and construct the required equipment and facilities, and the operating and maintenance costs associated with the alternative.

Capital Cost

The capital cost to implement Alternative 4 is between \$100,000,000 and \$260,000,000 depending on the actual composition of the waste materials and the need for treatment prior to disposal.

Operation & Maintenance Cost

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No operation and maintenance costs would be incurred with this alternative.

Summary – Alternative 4

Alternative 4 was not retained for further consideration because the high costs of removal, treatment and disposal make this alternative impractical. Alternatives 2 and 3 will meet the remedial action objectives at a lower cost.

6.2.5 Summary

This section discusses the results of the comparative evaluation for each remedial alternative for the OLF at RFETS. The results are also summarized in Table 6-1.

Alternative 1 would not prevent direct contact with the OLF debris or control the current erosional processes. However, it could be easily implemented and would be cost effective, relying wholly on active controls to limit risks. This alternative was not selected as the proposed accelerated action for the OLF.

Alternative 2 will prevent direct contact with the OLF debris and control erosional processes, with a short disruption of the PMJM habitat. The alternative is implementable. This alternative includes post-accelerated action institutional controls to maintain remedy effectiveness, but the controls are not difficult to implement. The primary drawback to Alternative 2 is that it exposes some waste during the slope stabilization process, and creates potential worker safety and environmental issues. This alternative is an effective accelerated action for the OLF because it is the most cost-effective and it implements the presumptive remedy.

Alternative 3 would prevent direct contact with the OLF debris and control erosional processes, but with additional disruption of the PMJM habitat and wetland removal. The alternative is implementable; however, construction is more difficult and requires more materials and use of heavy construction equipment. This alternative includes post-accelerated action institutional controls to maintain remedy effectiveness, but the controls are not difficult to implement. Alternative 3, like Alternative 2, also exposes some waste during the slope stabilization process.

Alternative 3 does not significantly provide for greater protection of the public and environment than Alternative 2 and exhibits greater short- and long-term impacts to the ecological environment. Alternative 3 may increase the risk of worker injury over that of Alternative 2 with the additional construction materials and heavy construction equipment. However, Alternative 3 does exhibit slightly higher stability factors of safety and, based on discussions with the regulators and stakeholders, has been selected as the proposed accelerated action.

Alternative 4 provides the highest level of protection for public health and the environment at the OLF with a short disruption of the PMJM habitat. However, it presents the highest risk to workers implementing the action. It is also extremely expensive due to the high cost of off-site disposal in licensed facilities. Because of the high cost and long construction duration, this alternative was not selected as the proposed accelerated action for the OLF.

7.0 PROPOSED REMEDIAL ACTION PLAN

The remedial action plan for the OLF will consist of the following major activities to meet the RAOs:

- Removal of surface soil "hot spots" (removal completed, see Appendix E);
- Limited grading of landfill to slope of 18 percent;
- Construction of a buttress fill;
- Placement of a 2-ft-thick soil cover over the entire fill area;
- Engineering controls;
- Site monitoring (groundwater and surface water); and
- Institutional controls.

The objectives of this action are principally met through the removal of surface soils that are contaminated above the soil action level and installation of the landfill soil cover. However, additional continuing actions are required to maintain and assess the protectiveness and effectiveness of the cover. Further discussion of the actions in relation to attaining to the extent practicable, ARARs is contained in Section 8.0. Further discussion of Long-Term Stewardship activities is contained in Appendix B.

These actions will be taken until final remedy requirements are selected and incorporated (along with post-closure requirements for remedial actions conducted at other IHSSs at Rocky Flats) in post-closure regulatory documents, which may include the final CAD/ROD for Rocky Flats or a post-closure RFCA-type agreement.

7.1 Removal of Surface Soil Hot Spots

Surface soil with concentrations above the WRW action levels were removed as shown on Figure 4-2. A description of the removal and confirmation sampling results are presented in Appendix E.

7.2 Area Grading

The waste fill area will be graded to generally an approximately 18-percent (5.5:1) slope using a cut-and-fill approach that will be as balanced as possible (See Figure 7-1). Standard earth-moving equipment, such as dozers, hoes or scrapers, will be used to cut the areas where the slope exceeds the desired 18 percent and to fill the areas where the slope is less than the desired 18 percent slope. It is estimated that approximately 55,000 cubic yards of waste fill material will be moved during the process and 105,000 cy of fill will be required to reach the 18-percent grade before placing the 2-ft cover.. The grading plan will be optimized in the design to add stormwater drainage swales, and run-on and runoff controls, as well as balance

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the overall cut/fill earthmoving yardages and include anticipated groundwater elevations and bedrock topography.

Control measures will be implemented during the grading process to prevent the spread and release of waste materials from the OLF. The control measures will include establishment of work zones, decontamination procedures, dust suppression methods, traction mats, visual inspections, and radiological surveys. Work will be suspended when environmental conditions could greatly increase the possibility of the spread of contaminated materials. Monitoring will be performed, as necessary, to verify that there has been no release of contaminated materials. Generally, the work will be conducted as if at a radiologically contaminated site using proper personal protective equipment (PPE), respiratory protection, and worker monitoring.

7.3 Buttress Fill

A buttress fill will be constructed at the toe of the waste and re-graded slope. A conceptual depiction of the buttress fill is shown in Figure 7-2. The buttress fill consists of a buttress drain to drain water from behind the fill and a structural earthen fill. Rocky Flats alluvium-type material will be used as the structural earthen fill. The buttress drain will consist of graded natural rock and designed to allow the groundwater captured by the drain to infiltrate into the soils downgradient of the buttress fill. Approximately 60,000 cubic yards of these natural, stable materials will be required to build the buttress fill.

7.3.1 Soil Cover

After grading of the landfill surface and construction of the buttress fill, a soil cover will be placed over the landfill to a minimum thickness of 2 ft. Approximately 65,000 cubic yards of local or onsite soil will be used to construct the cover. The soil cover will be sufficiently compacted to provide a stable cover system to promote surface water runoff, reduce surface water ponding, increase overall slope stability, and provide a suitable soil surface for revegetation.

Revegetation of the soil cover with native species will reduce erosion and help prevent the intrusion of noxious weeds. This approach is in keeping with the current strategy to restore RFETS with the native prairie grasslands as closely as possible. The seeding will be conducted, along with using erosion control matting or mulch, to prevent erosion of the cover while allowing the vegetation to establish a strong stand.

The following plant properties will ensure healthy, productive, and long-term vegetative growth on the landfill cover:

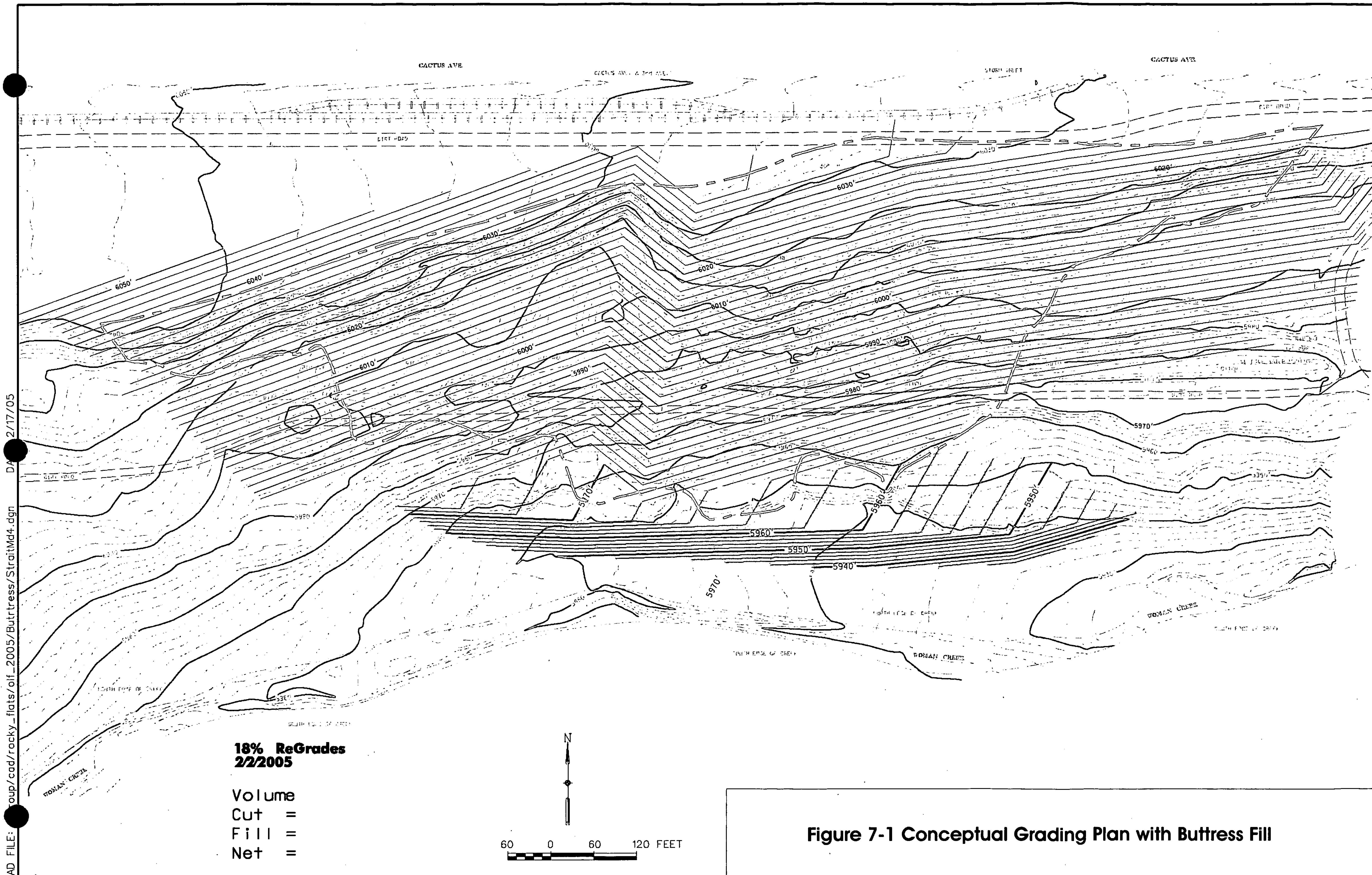

Figure 7-1 Conceptual Grading Plan with Buttress Fill

CAD FILE: ...oup/cad/rocky_flats/olf_2005/Buttress/StraitMd4.dgn DA... 2/17/05

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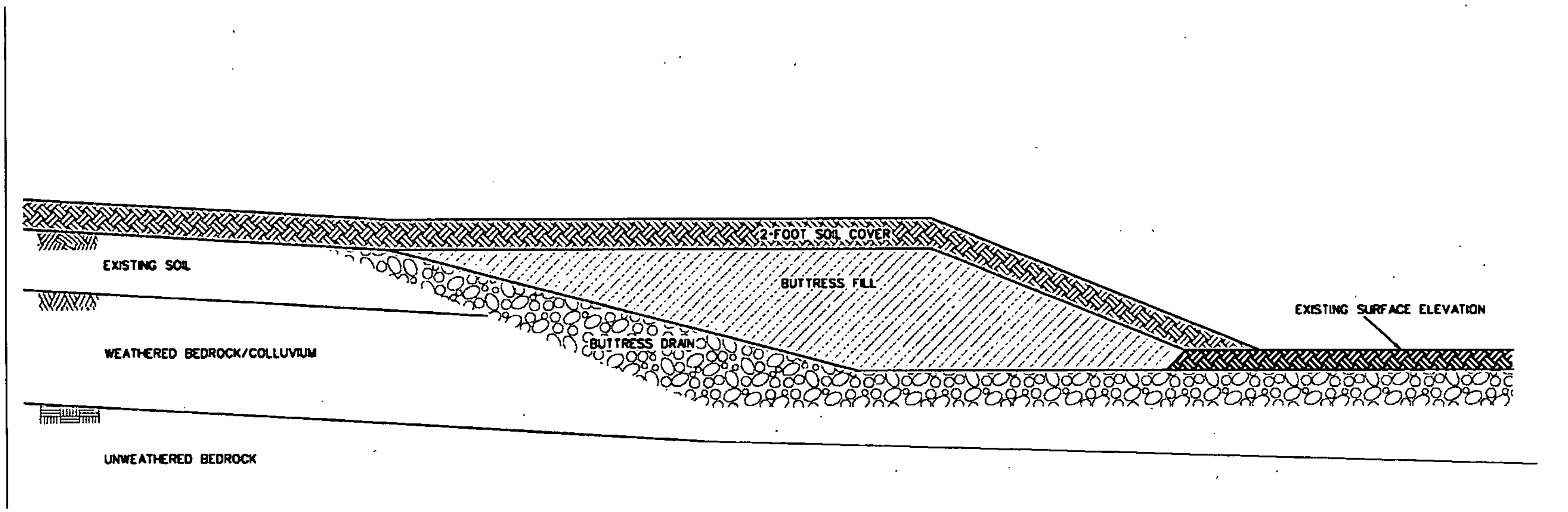
Figure 7-2 Conceptual Buttress Fill Design



- Locally-adapted, noninvasive or native species able to withstand Front Range drought and temperature extremes will be used as vegetative cover.

- Long-term fertilization and nutrient supplements are not planned at this time; therefore, it is critical that the vegetation be able to survive under existing soil conditions. Native grasses and forbs will thrive with little maintenance. Soil amendments may be provided to supplement borrow material to establish initial vegetation on the cover.

- Both cool and warm season species will be planted to provide transpiration throughout as much of the year as possible. Locally-adapted species of grasses and forbs normally transpire all available water in semiarid climates, such as that at RFETS.

- A strong stand of vegetation will limit cover erosion from both wind and water, and help prevent the intrusion of noxious weeds.

A draft seed mix will be developed during the design in consultation with the RFCA Parties, the RFETS Ecology Group, and other interested parties.

7.4 Engineering Controls

Engineering controls may be used to provide a physical barrier to protect the public and wildlife refuge workers from potential risks at the site. The engineering controls may include signage to limit public access. Signs to inform the public of limited access would be posted at 200-ft intervals.

7.5 Site Monitoring

Site monitoring will include a program to ensure that current conditions at the site do not change in an adverse manner. Surface water and groundwater monitoring will be instituted to identify impacts after the action has been implemented. An annual walkdown of the area will be conducted to identify areas of erosion of the soil cover and buttress fill for repair. A ground survey will also be completed to monitor slope stability. More details regarding site monitoring (including monitoring frequency and groundwater and surface water monitoring locations) are presented in Appendix B. Monitoring locations will be confirmed during the design of the accelerated action.

7.6 Institutional Controls

General and specific post-accelerated action institutional controls for RFETS as a whole are currently being evaluated by DOE and the regulatory agencies, and in consultation with the USFWS and the community.

The controls that will be implemented at the OLF for this proposed action are as follows:

1. Current Site-wide security and access controls will be maintained until completion of the RFETS Closure Project, currently scheduled for December 2006, but will be replaced by

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equivalent controls for the OLF and other specific areas for which security and access controls are required.

2. In accordance with the Rocky Flats Wildlife Refuge Act of 2001 (Pub.L. 107-107, Sec. 3171-3182 [December 28, 2001]), DOE will retain jurisdiction over the engineered controls associated with the proposed action.

3. Prohibition on drilling and pumping of groundwater wells for uses other than the remedy.

4. Prohibition on the use and excavation of the cover and the area in the immediate vicinity of the cover will be prohibited

5. Prohibition on drilling on and in the immediate vicinity of the cover will be prohibited.

6. Prohibition on disruption of surface water sampling stations until such stations are no longer needed will be prohibited.

7. To avoid adverse impacts, roads and trails will not be allowed on the cover or the immediate vicinity of the cover. Signs may be erected that indicate vehicles are prohibited from specific areas and that direct vehicle traffic appropriately. A determination will be made during project construction as to whether signs or barriers will be used as the preferred means of restricting access.

8. Upon construction completion, fencing at specific locations on or around the cover, will also be considered to limit the potential for damage or tampering with the Site. Signs and markers may be used as controls to delineate the landfill boundary; outline digging, fishing, swimming, groundwater, and surface use restrictions; and/or describe access restrictions to the landfill cover and monitoring locations for the cover.

Final institutional and physical controls for the accelerated action will also be documented in the Closeout Report. Inspection of these institutional controls will be performed quarterly to determine their continuing effectiveness. Results of these inspections will be reported annually.

7.7 Worker Health and Safety

All work under this proposed action will be controlled using the Site Integrated Safety Management System (ISMS) and the Integrated Work Control Program (IWCP). A project-specific HASP will be developed to address the safety and health hazards of project execution and specify the requirements and procedures for employee protection. The Occupational Safety and Health Administration (OSHA) construction standard for Hazardous Waste Operations and Emergency Response, 29 Code of Federal Regulations (CFR) 1926.65, will be used as the basis for the HASP. In addition, DOE Order 5480.9A, Construction Project Safety and Health Management, applies to this project. This Order requires preparation of an Activity Hazard Analyses (AHA) for each task, which includes identifying the task, hazards associated with the task, and controls necessary to eliminate or mitigate the hazards. The AHAs will be included in the HASP.

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Data and controls will be continually evaluated. If field conditions vary from the planned approach (for example, when unanticipated hazards are encountered, such as contaminated debris and airborne contamination), an AHA will be prepared for the new conditions, and work will proceed according to the appropriate control measures.

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8.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

As required by Part 4 of RFCA, the proposed action will be performed to the extent practicable in compliance with applicable or relevant and appropriate requirements (ARARs) under CERCLA. ARARs have been identified for the proposed action consistent with the NCP, the preambles to the proposed and final NCP, and CERCLA Compliance with Other Laws Manuals Part I and Part II (EPA 1988, 1989).

The ARARs are presented in Appendix A. This section provides additional detail for the ARARs related to the cover for the OLF, air, surface water, wetlands, wildlife and mineral resources.

As discussed in Section 4.0, the OLF has not impacted the environmental media outside the landfill boundary (surface water and groundwater) since its closure 36 years ago in 1968. The actions outlined in this IM/IRA will be designed to increase the protectiveness of the OLF. Specifically, the soil cover will be designed and built to perform the following functions:

- Prevent direct contact with the fill materials and commingled soil;
- Reduce and control the erosion of surface soil;
- Provide a separation layer between surface water runoff and the fill materials and contaminated soils;
- Reduce the ponding of stormwater by providing a continuous soil cover and positive drainage of stormwater flow off the cover;
- Provide for minimal impact to PMJM habitats; and
- Maintain or enhance stability characteristics of the OLF to minimize adverse impacts from potential future landsliding.

8.1 Landfill Cover Requirements

The proposed containment accelerated action for the OLF includes a cover that will be designed and constructed to meet Relevant and Appropriate requirements (ARARs). The Original Landfill will be closed consistent with the RCRA/CHWA closure performance standard for interim status units (6 Colorado Code of Regulations [CCR] 1007-3, Section 265.111).

This closure standard incorporates the cover design and performance standards in 40 CFR Part 265.310(a). This section focuses only on those 265.310(a) requirements that have been determined to be both relevant and appropriate to the OLF.

Specifically, the cover performance standards determined to be relevant and appropriate are 40 CFR 265.310(a)(2), (a)(3), and (a)(4), which require DOE to close the landfill with a final cover designed and constructed to:

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- Function with minimum maintenance;
- Promote drainage and minimize erosion or abrasion of the cover; and
- Accommodate settling and subsidence so that the cover's integrity is maintained.

To demonstrate compliance with these cover performance standards, the following sections discuss each of these requirements.

Ancillary activities performed concurrently with construction of a stable soil cover will include PMJM habitat protection, wetlands protection, surface water management, and site security. Compensatory mitigation for unavoidable impacts to wetlands will be provided in accordance with ARARs. Grading the surface of the landfill will control surface water runoff. Surface water will drain south and into Woman Creek.

Site security will be maintained during and after construction activities. Signs will be posted warning of potential danger at the landfill.

8.1.1 Function With Minimum Maintenance

Based on the evaluation of all the environmental and geotechnical data, the current soil cover and contour of the placed waste and commingled soil at the OLF do not present a significant hazard after over 36 years in this configuration. Implementation of the proposed accelerated action will further minimize landfill maintenance in the following areas:

- The regraded surface and 2-feet-thick cover will reduce cover maintenance by providing several feet of separation between the waste and surface of the landfill (prevent direct contact with the waste), by eliminating the erosion and sloughing of soils that have resulted from poor waste placement practices, and providing a more geotechnically stable landfill.
- Stormwater runon controls will divert surface water away from the OLF to reduce stormwater erosion.
- Stormwater runoff will be controlled by the grading/contouring of the landfill surface to eliminate ponding water and promote positive drainage from the landfill.
- The soil cover of the landfill will be vegetated to reduce surface erosion. This will also increase landfill stability by reducing groundwater levels through plant evapotranspiration.

8.1.2 Promote Drainage and Minimize Erosion or Abrasion of the Cover

The final cover will be designed to promote drainage and minimize erosion or abrasion on the surface of the cover in accordance with the performance standards discussed above in Section 8.1.1.

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8.1.3 Accommodate Settling and Subsidence to Maintain Cover's Integrity

Because the OLF has been inactive for 36 years, settling and subsidence are considered complete. However, to prevent any further movement, the following observations are noted:

- The waste is currently commingled with soil (over 50 percent), which reduces the extent of settling and subsidence.
- The proposed accelerated action will reposition and recompact some of the waste and commingled soil to further reduce settling and subsidence.
- Appropriate method compaction specifications will be developed to provide the appropriate levels of compaction to reduce settling and subsidence.
- Furthermore, a soil cover is very flexible with regard to settling and subsidence and also extremely easy to repair should the need arise.

8.2 Air

The proposed action has the potential to generate fugitive particulate emissions, but very little potential for hazardous air pollutant emissions. Subpart H of 40 CFR Part 61 contains the requirements for monitoring and reporting activities within DOE facilities that have the potential to emit radionuclides other than radon. Potential emissions from the proposed action that may affect 40 CFR 61 compliance have not been identified; however, normal perimeter National Emission Standards for Hazardous Air Pollutants (NESHAPs) compliance air monitoring will be conducted during the cover installation.

Colorado Regulation No. 1 (5 CCR 1001-3) governs opacity and particulate emissions. Section II of Regulation No. 1 addresses opacity and prohibits stack emissions from fuel-fired equipment exceeding 20 percent opacity. Section III addresses the control of particulate emissions. Fugitive particulate emissions will be generated from construction and transportation activities. During construction activities, dust minimization techniques, such as water sprays, will be used to minimize suspension of particulates. In addition, construction activities will not be conducted during periods of high wind. The substantive requirements of Regulation No. 1 will be incorporated into a Dust Control Plan, which will define the level of particulate control for the project.

Colorado Regulation No. 3 (5 CCR 1001-5) provides CDPHE with the authority to inventory emissions, and Part A describes Air Pollutant Emission Notice (APEN) requirements. Air quality management subject matter experts will evaluate the project emissions and, if applicable, an APEN will be prepared to facilitate CDPHE's inventory process.

The final surface of the landfill cover will appropriately reduce the potential post-accelerated action wind erosion of soil and subsequent particulate emissions. Significant air emissions are not anticipated after the closure construction is complete.

8.3 Surface Water

The proposed action has the potential to impact surface water during construction. As described in the following paragraphs, impacts will be minimized by meeting the substantive requirements of the Clean Water Act and associated implementing regulations.

8.3.1 Stormwater

Given the expected conditions at the OLF site, no significant surface water impacts are anticipated as a result of stormwater events. However, because the total area of the project is greater than 1 acre and the location is outside the IA, which has an effective National Pollutant Discharge Elimination System (NPDES) Permit for Storm Water, the proposed action would require an NPDES Storm Water Permit for Construction Activities, except for the fact that it is a CERCLA action, Paragraphs 16 and 17 of RFCA, establish the requirements under which a CERCLA permit waiver applies. For any action that would require a permit except for CERCLA, Paragraph 17 requires that certain information be included in the submittal.

Permit Required

Because the landfill cover construction project is greater than 1 acres in size and lies outside of the Site's IA, an NPDES General Storm Water Permit for Construction Activities would be required. The permit is found at 40 CFR Part 122, and is obtained by filing a Notification of Intent (NOI) with EPA. This IM/IRA serves as the NOI for the OLF.

Requirements to Obtain a Permit

Because the stormwater permit for construction activities is a general permit, it has been through public comment and promulgated by EPA. Obtaining the permit was done through the NOI (that is, a letter submittal to the agency containing basic information about the project). The permit requires installation of best management practices (BMPs) and structural stormwater controls, such as silt fences, to protect downstream waters from potential surface water contaminants (for example, sediment-laden runoff). These requirements will be part of the cover design.

How Stormwater Control Measures Meet the Requirements

The total area of disturbed soil is approximately 22 acres, including the area of the landfill to be resurfaced (20 acres) and miscellaneous construction activities (2 acres). Surface water control measures will be used to minimize surface water contact with potentially contaminated soil or groundwater and minimize erosional effects during the construction activities. Precipitation falling on areas where construction is in progress will be diverted to existing surface water drainage ditches. Other shallow ditches will be temporarily constructed as needed to prevent sediment-laden stormwater from flowing directly into Woman Creek. Newly-constructed soil surfaces will be stabilized using soil terracing, revegetation hydromulch, straw-mulch, silt fencing, straw waddles, and other stormwater BMPs to minimize soil erosion, sediment transport, and surface water quality degradation until the required vegetation is established. The use of straw-mulch, straw waddles, adequately spaced silt fences, and other appropriate measures minimizes soil loss and allows the vegetation to become established.

8.3.2 Remediation Wastewater

Remediation wastewater generated during construction activities is not expected; however, if produced, it will be managed consistent with provisions of the RFCA Implementation Guidance Document (IGD) (DOE et al. 1999). Remediation wastewater, if produced, will be collected, characterized, and treated on or off site if required, directly discharged in accordance with requirements of the Site's Incidental Waters Program (K-H 2003a).

8.4 Wetlands

As described in Section 3.8, the U.S. Army Corps of Engineers has designated wetlands within the construction area. DOE will mitigate the permanent loss of wetlands resulting from the remediation construction in accordance with a Wetland Mitigation Plan to be prepared as part of the remedial action design (see Appendix E).

8.5 Wildlife

Construction activities will remove jurisdictional wetlands and a portion of the PMJM protection area within the boundary of the OLF. Formal consultation with USFWS will be required. Wetland and PMJM habitat mitigation may be required. However, disruption of the PMJM habitat is temporary. Mitigation plans will be developed during design of the action, as required.

Construction activities may impact migratory birds protected by the Migratory Bird Treaty Act. Due to the variations in potential impacts depending upon the season and nesting schedules for migratory birds, the substantive requirements of these federal statutes will be evaluated by the Site Ecology Group prior to conducting activities associated with the proposed action. The substantive requirements identified during the evaluation will be implemented throughout the construction process.

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9.0 ENVIRONMENTAL IMPACTS

Paragraph 95 of RFCA mandates incorporation of National Environmental Policy Act (NEPA) values into RFETS decision documents. This section of the IM/IRA satisfies the RFCA requirement for a "NEPA equivalency" assessment of environmental consequences by addressing the environmental consequences of the proposed accelerated action.

The remediation impact analysis relies heavily on conclusions reached in the Cumulative Impact Document (CID) (DOE 1997) and the 2000 CID Update Report (DOE 2001), both of which focus on cumulative impacts resulting from on-site closure activities. In general, the proposed action will have very few adverse short-term impacts on a variety of resource areas, including air quality, water quality, traffic congestion, and ecological resources. In some instances, the impacts could be intense for a short period of time. However, the impacts will not notably affect human health and safety, or the environment, and they will be temporary and controlled through mitigation actions (for example, dust will be controlled with water sprays during placement of the cover).

The proposed action will have both positive and adverse effects, each identified in this section. Certain mitigation measures are required by law and are also identified for each resource area.

9.1 Impacts to Air Quality

The purpose of this section is to assess the potential impacts to air quality associated with implementation of the proposed accelerated action (regraded surface with soil cover), including fugitive dust emissions and methane emissions.

9.1.1 Potential Fugitive Dust Emissions

The primary pollutant generated as a result of the proposed action will be fugitive dust, which includes total suspended particulates (TSP) and particulate matter 10 micron (PM_{10}), and particulate matter 2.5 microns ($PM_{2.5}$) in size. Dust emissions from the regrading and cover construction activities will be controlled with practical, economically reasonable, and technologically feasible work practices, as required by the CAQCC Regulation No. 1. Specifically, on-site dust will be controlled through dust minimization techniques, such as the use of water sprays to minimize suspension of particulates, and terminating earthmoving operations during periods of high wind. In addition, PM10 will be monitored consistent with the Site IMP (RFETS 2000). Particulate emissions will be short-term and controllable, and emissions are not expected to be above enforceable National Ambient Air Quality Standards (NAAQSs) at the RFETS perimeter. Therefore, potential impacts to workers and the public from proposed action will not be significant.

9.1.2 Potential Equipment Emissions

The regrading and cover construction activities will also include operation of vehicles, heavy machinery, and other equipment that generate other criteria pollutants. Estimated concentrations of other criteria and Hazardous Air Pollutants provided in the CID (DOE

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1997) were well below the most restrictive occupational exposure limit, with the exceptions of sulfur dioxide, nitrogen dioxide, and carbon monoxide, which approached 50 percent of the most restrictive occupational exposure limit. The CID (DOE 1997) identified the primary sources of these pollutants as diesel-powered emergency generators used to supply backup power at RFETS. According to the 2000 CID Update Report (DOE 2001), maximum daily emissions will remain about the same as forecast in the CID (DOE 1997). Equipment emissions from construction activities at the OLF are expected to be substantially less than the CID (DOE 1997) and 2000 CID Update Report (DOE 2001) estimates; therefore, impacts to workers and the public are not a concern.

9.2 Impacts to Surface Water

Construction activities at the OLF will result in surface disturbance from the clearing of vegetation, excavation and salvage of topsoil material, blading and leveling of the land, the potential for accidental uncovering of contaminated media, and the construction of the soil cover. Potential impacts to surface water during the construction phase include increased erosion, and subsequent sediment loading to drainage ditches and Woman Creek during storm events. The absence of vegetative cover results in increased potential for both sheet and channelized runoff, as well as wind and water erosion, resulting in increased sedimentation of ditches and Woman Creek. Erosion controls will be implemented during construction to reduce these impacts.

The soil cover construction will require soil obtained from off-site commercial operations or on-site sources. Excavation of these borrow materials has impacts similar to those identified above. Off-site facilities address these issues through permits issued to the facility.

The construction activities are expected to result in limited physical contact with contaminated soils or waste materials. In the event equipment and personnel come in contact with potentially contaminated materials during construction, decontamination will be performed at the RFETS main decontamination facility or a temporary decontamination facility at the OLF to reduce potential impacts to surface water.

Long-term impacts will remain minimal because the regrading, soil cover, and revegetation will minimize infiltration of precipitation and subsequent contact with contaminants. The proposed accelerated action will also incorporate surface drainage features to control runon/runoff and provide surface erosion control. The proposed action will result in a decrease in the risk of contaminants reaching surface water by:

- Preventing direct contact of precipitation with the waste materials and commingled soil;
- Providing Stormwater runon and runoff controls; and
- Reducing soil erosion by providing temporary, engineered erosion controls and cover revegetation.

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Precipitation falling within the boundary of the landfill will be drained from the cover and diverted away from the landfill. Surface water drainage from areas outside the OLF boundary will be prevented from flowing onto the landfill and diverted around the boundary. Using appropriate surface-reclamation measures, adequate vegetative cover will be established on the final surface of the landfill. The establishment of vegetative cover on the new slopes and contours of the landfill, and the surrounding disturbed surfaces, will greatly reduce erosional hazards to levels similar to surrounding areas.

Post-accelerated action monitoring activities will include inspections of the landfill surface and associated drainage ditch conditions. Observations of the vegetative cover and evidence of soil erosion and loss will be included in the routine inspection and maintenance activities. Further erosion control measures, regrading, and revegetation will be implemented if maintenance inspections indicate the landfill surface erosion controls are not as effective as planned.

The SID in the area of the OLF will be eliminated by implementing the proposed action. The SID will be effectively replaced with installation of the soil cover. Removal of the SID will enhance the overall stability of the landfill by eliminating the existing ponding of stormwater on the OLF.

9.2.1 Woman Creek Floodplain

The floodplain boundary for the Woman Creek drainage, for the 100-year, 6-hour storm event, is mapped in the *Rocky Flats Plant Drainage and Flood Control Master Plan (Figure VI-2, Sheet 10)* (EG&G 1992). The precipitation depth used for the analysis of the 100-year, 6-hour storm is 3.8 inches.

Water surface elevations of peak flows generated during the 100-year storm were determined using the HEC-2 computer program. The HEC-2 program, first developed by the U.S. Army Corps of Engineers in 1964, allows for computation of surface water profiles in irregularly shaped channels using backwater analysis. It is noted that the configuration of RFETS used for the HEC-2 modeling, with the Industrial Area intact, is different than the future RFETS configuration, with the Industrial Area removed. However, since planned changes to the Industrial Area are not anticipated to measurably impact the Woman Creek hydrology near the Original Landfill (K-H 2002), the floodplain in that reach of Woman Creek, determined using HEC-2, may still be used.

The Woman Creek floodplain for the 100-year, 6-hour storm overlaps the area of the Original Landfill cover by approximately 11,000 square feet (0.25 acres) at the bottom of the slope. In that floodplain area, the model-estimated peak flow rate for Woman Creek is approximately 450 cubic feet per second, with a velocity of approximately 7 feet per second. The presence of the landfill cover is not expected to have an appreciable impact on the floodplain. Since the floodplain and Original Landfill area overlap, the engineering design for the landfill cover and buttress features must take the floodplain into consideration. To the extent possible, the engineering design for the landfill cover and buttress features will mitigate the adverse effects of the action in the floodplain.

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9.3 Impacts to Groundwater

Groundwater quality in the area of the OLF is not significantly impacted. The intended purpose of the cover is to prevent contact with landfill material. The regraded cover will also reduce surface water from percolating through the landfill to groundwater by eliminating the existing ponding of stormwater. The regraded soil cover will provide an overall positive impact to groundwater and will continue to protect groundwater quality at the site. No significant negative impact to groundwater quality is expected from implementation of the accelerated action.

9.4 Impacts to Wildlife and Vegetation

The OLF construction activities will have varying impacts on ecological resources within the project area. Impacts to ecological resources are unavoidable; however, adverse impacts will be minimized through mitigative measures. The Proposed Action will principally affect wetlands, migratory bird habitat, and habitat for the PMJM (*Zapus hudsonius preblei*), a federally-listed threatened species under the Endangered Species Act. Impacts to the PMJM and wetlands may require mitigation (that is, a replacement of habitat of equal value either on or offsite). Habitat for native animals will change slightly, as the hillside is regraded and revegetated during construction of the proposed accelerated action. However, the changes will improve the quality of the vegetation by replacing exotic species with native species. The changes will adversely affect some species for a short time, but will likely have a long-term benefit for most endemic species.

Because the PMJM is a federally-listed threatened species, its habitat is a primary concern at RFETS. Several acres of PMJM habitat are located on RFETS. The PMJM is found in the riparian woodland/shrubland habitat along Woman Creek, and designated PMJM habitat extends into the southern portion of the OLF area as shown on Figure 3-4. Some designated PMJM habitat will be lost permanently within the project area because of soil cover (landfill cap) constraints. However, some of PMJM habitat will be only temporarily impacted by the project. Both temporary and permanent impacts will be mitigated through consultation with the USFWS.

Other animal species will lose existing habitat when the construction of accelerated action is completed. The regraded soil cover may limit the types of animals that eventually occupy the area. The changes, however, will benefit yet other species. Many endemic species are adapted to prairie environments and would readily inhabit the reconfigured OLF.

Migratory birds are protected under the Migratory Bird Treaty Act. Both the birds and their nests are protected under this law. Songbirds occasionally nest in the trees and shrubs or on the ground in the OLF area. Active nests will be protected; inactive nests will be removed prior to construction activities, through the use of special permits from the USFWS. While long-term habitat changes that result from the proposed action will adversely affect some bird species (for example, loss of a nesting site for owls), other species (for example, grassland species) will benefit from the changes.

Much of the OLF project area is currently dominated by noxious weed species, such as diffuse knapweed and scotch thistle. These weeds have invaded the disturbed ground within

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the project area over the past decade. Additionally, non-native species of grasses, such as smooth brome and intermediate wheatgrass, were planted along the SID after it was constructed. These non-native species will be replaced with native species that provide better wildlife forage and habitat, and increase the natural resource values of the area.

There are several small wetland areas within the boundary of the OLF project area that will be destroyed. The impacted areas are subdivided as follows:

- SID Wetlands: The entire SID wetland area is 3.06 acres; the portion of the SID that will be affected by the proposed action is 0.34 acres.
- Woman Creek Wetlands: The proposed accelerated action is not expected to impact the wetlands in Woman Creek.
- Candidate Wetlands: Eight small isolated areas identified as potential wetlands, totaling approximately 0.91 acres, are located north of the SID. Designation of these areas as "jurisdictional" is currently in discussion.

A conceptual approach to mitigating wetland damage at the OLF is being developed. The approach to offset wetland losses is based on a worst-case scenario, wherein all wetlands on the hillsides and along Woman Creek are impacted. A Wetlands Mitigation Plan will be prepared that describes the actions that will be taken to replace wetlands that are destroyed. Both in-situ wetland creation/restoration and the use of wetland bank credits have been proposed for mitigation of wetland impacts. The use of either technique or a combination of the techniques is subject to review and approval. The mitigative measures are therefore considered sufficient to offset losses and other adverse impacts to wetlands.

The OLF project may temporarily affect water quality from eroded soil during construction. Erosion controls will be used to minimize water quality effects. Surface water flow volumes may change due to the design of the new landfill cover. Such changes would be minimal and would occur sporadically (for example, after heavy rains). The minor potential changes in surface water flow volumes will not change or affect lower Platte River species that depend on instream flows.

Soil materials will be obtained from off-site commercial operations for fill and cover operations, and the excavation of borrow materials will impact wildlife and vegetation at those locations. Commercial facilities must comply with the Endangered Species Act, and threatened and endangered species are therefore protected. The impact to other species will vary but will depend on the facility and extent of the operations. However, these indirect impacts are considered in operational permits issued for the facilities by state and local county governments.

9.5 Impacts to Nearby Populations

In accordance with Executive Order 12898, the potential impact of the proposed action on minority and low-income populations is considered. The proposed action will occur on site away from inhabited areas, and will not lead to off-site indirect effects on nearby populations. Disproportionately high and adverse human health or environmental effects will not be imposed on these populations. The proposed action will provide short-term employment for a limited number of people, and socioeconomic effects of the action will be minimal.

9.6 Impacts to Transportation

The proposed accelerated action will only slightly impact both on-site and off-site transportation systems. Increased on-site truck traffic will be an inconvenience; however, safety risks will be low, and impacts will be mitigated by very low and closely observed speed limits. In comparison analyses in the CID (DOE 1997; 2001), off-site traffic impacts will not increase substantially.

9.7 Impacts to Cultural and Historic Resources

RFETS was placed on the National Register of Historic Places as a Historic District (5JF1227) on May 19, 1997. Historic District designation mandates compliance with the Historic Preservation Act of 1966, and the Programmatic Agreement among DOE, the Colorado State Historic Preservation Officer, and the Advisory Council on Historic Preservation Regarding Historic Properties at RFETS. Although the action will be conducted within the Historic District boundaries, no impact is expected to occur to protected structures.

9.8 Impacts to Visual Resources

During installation of the cover, bulldozers and other equipment may be visible from off-site locations. Dust generated during earthmoving operations may be temporarily visible, but will dissipate before leaving the Site as a visible cloud or plume of dust. Control measures, such as watering, will be used if needed to control dust.

9.9 Noise Impacts

Noise levels may be elevated during construction of the accelerated action. Noise levels will not exceed those commonly encountered at a highway construction site. Appropriate hearing protection will be supplied to project personnel as identified in the project-specific HASP.

9.10 Cumulative Impacts

The proposed action supports the overall mission to clean up RFETS and make it safe for future uses. The cumulative effects of this broad, Sitewide effort are presented in the CID (DOE 1997) and 2000 CID Update Report (DOE 2001), which describe the short- and long-term effects from the overall cleanup mission.

The primary focus of the CID (DOE 1997) is cumulative impacts resulting from on-site activities conducted during Site closure. Cumulative impacts result from the effects of Site closure activities and other actions taken during the same time in the same geographic area, including off-site activities, regardless of what agency or person undertakes such other actions. The analysis contained in the 2000 CID Update Report (DOE 2001) included updated on-site and off-site transportation activities, as well as several new off-site activities,

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although the future non-DOE projects are relatively uncertain. Increased traffic congestion will be the most noticeable impact according to the 2000 CID Update Report (DOE 2001), resulting from increased RFETS traffic and other planned or proposed construction projects near RFETS. Air pollutants and noise will also have adverse impacts; however, the impacts are expected to be short-term in nature, with staggered project start and completion dates. Most people will perceive a positive, long-term visual and "quality of life" benefit, as RFETS infrastructure and equipment are removed, returning RFETS to a more natural appearance.

The cumulative impacts of the proposed action are expected to be similar to those analyzed in the CID (DOE 1997) and 2000 CID Update Report (DOE 2001). Over the short term, additional construction personnel will have an additive effect on the existing workload for Site operations, and there will be increased air emissions, visual impacts, noise, and traffic impacts resulting from construction activities. These short-term impacts will be minimal. Long-term impacts (that is, OLF cover construction activities in conjunction with other environmental restoration work and facility decommissioning activities) facilitate future use of the Site and fulfill the mandated cleanup objectives.

9.11 Irreversible & Irretrievable Commitment of Resources

The proposed action will result in a variety of permanent commitments of resources; however, it is not expected to result in a substantial loss of valuable resources. Most of the resources used for construction of the accelerated action will be permanently committed to the implementation. Irreversible and irretrievable resources are defined as resources that are either consumed, committed, or lost. At the OLF, irreversible and irretrievable resources include the following:

- Consumptive use of geological resources (for example, quarried rock, clay, sand, and gravel for road construction) will be required for construction activities. Supplies of these materials will be provided either by on-site or off-site commercial borrow source. The proposed action requires a permanent commitment of fill, soil, and vegetative cover to construct the OLF cover. Adequate supplies are available without affecting local demand for these products.

- Fuel consumed by construction equipment and vehicles used for the construction of the OLF cover will not be recovered.

- Soil in the vicinity of the OLF will be disturbed by construction activities. Many impacts are temporary, pending completion of accelerated action activities and associated revegetation.

- The commitment of up to 25 acres of land as a landfill permanently commits and constrains the area to limited land-use options.

- Wetlands and associated natural resources will be reduced at the OLF. Long-term direct impacts to the floodplain resulting in changes of flood elevations will not occur.

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- A long-term commitment of personnel and funds will be required to perform post-accelerated action inspection, maintenance, and monitoring activities.

- Commercial, industrial, and residential land uses are permanently prohibited within boundaries of the OLF due to construction of the cover and the network of monitoring wells.

- Incidental resources that are consumed, committed, or lost on a temporary and/or partial basis during construction include construction personnel and equipment, the construction water source, and construction materials for staging and access.

- Appropriate landfill surface revegetation will result in an acceptable appearance of the site, and the ecological succession of the closed landfill and adjacent land will be improved by surface revegetation. Vegetation and habitat will eventually become similar to surrounding areas.

- Monitoring and maintenance activities will be performed, as necessary, to ensure long-term protection of human health and the environment.

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10.0 IMPLEMENTATION SCHEDULE

It is anticipated that the remedial action will take just over 6 months to complete and be implemented during Fiscal Year 2005. The approximate schedule for work follows.

- Mobilization – 20 days
- Pregrade Cut – 30 days
- Pregrade Fill – 70 days
- Fine Grading – 20 days
- Soil Cover – 40 days
- Vegetation and Erosion Control – 10 days
- Demobilization – 10 days

Most of these activities will be performed with some concurrent overlap. A detailed schedule for the construction will be developed during the design.

11.0 CLOSEOUT REPORT

Upon completion of the accelerated action at the OLF, a Closeout Report will be prepared in accordance with RFCA. The Closeout Report will document the work completed within the scope of this IM/IRA. The expected outline/content for the Closeout Report is as follows:

- Introduction;
- Remedial action description;
- Dates and duration of specific activities;
- Deviations from the decision document, if any;
- Final disposition of any wastes generated;
- Demarcation of wastes left in place (that is survey benchmarks and measurements);
- Demarcation of areas requiring access controls;
- A copy of the Vegetation Plan; and
- A copy of the Monitoring and Maintenance Plan.

Upon completion, the Closeout Report will be submitted for review and approval by CDPHE, and placed in the Administrative Record File.

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12.0 ADMINISTRATIVE RECORD

The Administrative Record (AR) File for the proposed accelerated action to be conducted pursuant to this IM/IRA is available in the Rocky Flats Reading Room, located at:

Front Range Community College
3705 112th Avenue
Westminster, Colorado 80030

(303) 469-4435.

The AR File contains the references listed in Section 15.0, References.

Upon approval of the Final IM/IRA, the AR will consist of the approval letter, Final IM/IRA (which will include a Comment Responsiveness Summary), references listed in Section 15.0, References, and any additional documents identified in the Final IM/IRA for inclusion in the AR.

An AR File for the implementation phase of the Final IM/IRA will be maintained as governed by Site AR policies and procedures, pursuant to the RFCA Community Relation Plan. The Final Closeout Report for the project will be included in the AR File. In addition, project-specific information, such as project correspondence, work control documents, and other information generated as a direct result of this project, will be filed in the Project Record. The Project Record files will be transferred to Site Records Management upon completion of the Final Closeout Report.

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13.0 COMMENT RESPONSIVENESS SUMMARY

Responses to comments on this IM/IRA received during the formal public comment period, including comments from the regulatory agencies, will be documented in the Appendix H.

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Appendix A

ARARs

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Appendix A – Applicable or Relevant and Appropriate Requirements

Requirement	Citation	Type	Comment
ATOMIC ENERGY ACT (AEA) [42 USC 2200 et. seq.]			
CHRONIC BERYLLIUM DISEASE PREVENTION PROGRAM	10 CFR 850	A	Establishes a program to reduce the number of workers currently exposed to beryllium in the course of their work at DOE facilities. The cited sections are followed in relation to determinations of beryllium contamination for waste management and for release to the public.
• Definitions	.3		
• Release Criteria	.31		
• Waste Disposal	.32		
• Warning Labels	.38 (b-c)		
CLEAN AIR ACT (CAA), 42 USC 7401 *et seq.*			
COLORADO AIR QUALITY CONTROL COMMISSION (CAQCC) REGULATIONS	5 CCR 1001 (40 CFR 52, SUBPART G)		
• Emission Control Regulations for Particulates, Smokes, Carbon Monoxide, and Sulfur Oxides	5 CCR 1001-3 (CAQCC Reg. No. 1)		
➢ Smoke and Opacity	Section II.A.1	C	Air pollutant emissions from stationary sources (e.g., fuel-fired pumps, generators, and compressors, process vents/stacks) shall not exceed 20% opacity.
➢ Fugitive Particulate Emissions	Section III.D	A	Technologically feasible and economically reasonable control measures and operating procedures will be employed to reduce, prevent, and control particulate emissions.
▪ Construction Activities	III.D.2(b)		
▪ Storage and Handling of Material	III.D.2(c)		
▪ Haul Roads	III.D.2(e)		
▪ Haul Trucks	III.D.2(f)		
• Air Pollutant Emission Notices (APEN), Construction Permits and Fees, Operating Permits, and Including the Prevention of Significant Deterioration	5 CCR 1001-5 (CAQCC Reg. No. 3)		
➢ APEN Requirements	Part A, Section II	C	An APEN shall be filed with CDPHE prior to construction, modification, or alteration

A – Action-Specific ARAR; C- Chemical-Specific ARAR; L – Location-Specific ARAR; TBC – To Be Considered

Appendix A – Applicable or Relevant and Appropriate Requirements

Requirement	Citation	Type	Comment
CLEAN AIR ACT (CAA), 42 USC 7401 *et seq.*			of, or allowing emissions of air pollutants from, any activity. Certain activities are exempted from APEN requirements per specific exemptions listed in the regulation.
➢ Construction Permits, Including Regulations for the Prevention of Significant Deterioration (PDS)	Part B		Construction permits are not required for CERCLA activities; however, substantive requirements that would normally be associated with construction permits will apply.
▪ Construction Permits	Section III	C	Construction permits are not required for CERCLA activities; however, substantive requirements that would normally be associated with construction permits will apply. Also, fuel-fired equipment (e.g., generators, compressors) associated with these activities may require permitting.
▪ Non-Attainment Area Requirements	Section IV.D.2	A/C/L	Even though CERCLA activities are exempt from construction permit requirements, non-attainment area requirements may apply if emissions of certain pollutants exceed certain threshold limits. The requirements include emissions reductions or offsets, and strict emission control requirements. Although RFETS is no longer a non-attainment area, this requirement is retained in the event the non-attainment designation changes.
▪ Prevention of Significant Deterioration Requirements	Section IV.D.3	A/C/L	Even though CERCLA activities are exempt from construction permit requirements, PSD requirements may apply if emissions of certain pollutants exceed certain threshold limits. The requirements include strict emission control requirements, source impact modeling, and pre-construction and post-construction monitoring.
• Emissions of Volatile Organic Compounds (VOCs)	5 CCR 1001-9 (CAQCC Reg. No. 7)		
• General Requirements for Storage and Transfer of VOCs	Section III.B	A	Applies to the transfer of VOCs to a tank larger than 56 gallons. In such cases, submerged-fill or bottom-fill techniques must be used.
• Disposal of VOCs	Section V	A	Prohibits the disposal of VOCs by evaporation or spillage.
• Storage and Transfer of Petroleum Liquid	Section VI	A	Regulated storage and transfer of petroleum liquids.
• Control of Hazardous Air Pollutants	5 CCR 1001-10 (CAQCC Reg. No. 8), 40 CFR 61, Subpart A		This subpart details the general provisions that apply to sources subject to National Emission Standards for Hazardous Air Pollutants (NESHAPs).
• National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities	5 CCR 1001-10 (CAQCC Reg. No. 8) 40 CFR 61, Subpart H		

A – Action-Specific ARAR; C- Chemical-Specific ARAR; L – Location-Specific ARAR; TBC – To Be Considered

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Appendix A – Applicable or Relevant and Appropriate Requirements

Requirement	Citation	Type	Comment
CLEAN AIR ACT (CAA), 42 USC 7401 *et seq.*			
➢ Standard	61.92	C/L	This section establishes a radionuclide emission standard equal to those emissions that yield an effective does equivalent (EDE) of 10 mrem/year to any member of the public. The perimeter samplers in the Radioactive Ambient Air Monitoring Program (RAAMP) sampler network are used to verify compliance with the standard.
➢ Emission Monitoring and Test Procedures	61.93	C/A	This section establishes emission monitoring and testing protocols required to measure radionuclide emissions and calculated EDEs. This section also requires that radionuclide emissions measurements (i.e., stack monitoring) be made at all release points that have a potential to discharge radionuclides into the air which could cause an EDE to the most impacted member of the public in excess of 1% of the standard (i.e., 0.1 mrem/year).
➢ Compliance and Reporting	61.96	C/L	This section requires the Site to perform radionuclide air emission assessments of all new and modified sources. For sources that exceed the 0.1 mrem/year EDE threshold (controlled), the appropriate applications for approval must be submitted to EPA and CDPHE. Additional substantive requirements may apply if the activity requires agency approval.

FEDERAL WATER POLLUTION CONTROL ACT (aka Clean Water Act [CWA]), 33 USC 1251 *et seq.*			
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM REGULATION • Storm Water Permit for Construction Activities • General Permits	 40 CFR 122.26 40 CFR 122.28	 A/L A/L	
DISCHARGES OF DREDGED OR FILL MATERIAL INTO WATERS OF THE UNITED STATES • Discharges Requiring Permits	33 USC 1344 33 CFR 323.3	A/L	
DOE COMPLIANCE WITH FLOODPLAIN/WETLANDS ENVIRONMENTAL REVIEW REQUIREMENTS COMPLIANCE WITH FLOODPLAIN/WETLANDS ENVIRONMENTAL REVIEW REQUIREMENTS	10 CFR 1022	A/L	

A – Action-Specific ARAR; C- Chemical-Specific ARAR; L – Location-Specific ARAR; TBC – To Be Considered

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Appendix A – Applicable or Relevant and Appropriate Requirements

Requirement	Citation	Type	Comment
FEDERAL WATER POLLUTION CONTROL ACT (aka Clean Water Act [CWA]), 33 USC 1251 *et seq.*			
• Floodplain/Wetlands Determination • Floodplain/Wetlands Assessment • Applicant Responsibilities	.11 .12 .13		
MIGRATORY BIRD TREATY ACT, 16 USC 701 *et seq.*			
TAKING, POSSESSION, TRANSPORTATION, SALE, PURCHASE, BARTER, EXPORTATION, AND IMPORTATION OF WILDLIFE AND PLANTS	50 CFR 10	A/L	Principally focuses on the taking and possession of birds protected under this regulation. Enforcement is predicated on location of the project and time of the year. Current list of protected birds is maintained by the Site Ecology group.
NATURAL RESOURCE AND WILDLIFE PROTECTION LAWS			
EARLY CONSULTATION	50 CFR 402.11	A/L	Identify and minimize early in the planning stage of action, any potential conflicts between the action and federally listed species.
BIOLOGICAL ASSESSMENT • Purpose • Preparation Requirements • Request for Information • Director's Response - No Listed Species or Critical Habitat Present - Listed Species or Critical Habitat Present • Verification of Current Accuracy or Species List • Contents • Identical/Similar to Previous Action • Permit Requirement • Completion Time • Submission of Biological Assessment	50 CFR 402.12	A/L	This is the process DOE needs to follow to evaluate the potential effects of the action on listed and proposed species and designated and proposed critical habitat and determine whether any such species or habitat are likely to be adversely affected by the action and is used in determining whether formal consultation or a conference is necessary.

A – Action-Specific ARAR; C- Chemical-Specific ARAR; L – Location-Specific ARAR; TBC – To Be Considered

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Appendix A – Applicable or Relevant and Appropriate Requirements

Requirement	Citation	Type	Comment
• Use of Biological Assessment			
INTERAGENCY COOPERATION • Informal Consultation	50 CFR 402	A/L	This is an optional process that includes all discussions, correspondence, etc., between the USFWS and the DOE. IT is designed to assist in determining whether formal consultation or a conference is required. If during it is determined by the DOE with concurrence of the USFWS that the action is not likely to adversely affect listed species or critical habitat, the consultation process is terminated and no further action is necessary. DOE shall review its actions at the earliest possible time to determine whether any action may affect listed species or critical habitat.

SOLID WASTE DISPOSAL ACT (aka: Resource Conservation and Recovery Act [RCRA]), 42 USC 6901 *et seq.*; SUBTITLE C: HAZARDOUS WASTE MANAGEMENT (Colorado Hazardous Waste Act [CHWA]), CRS 25-15-101 to -217			
Although the Colorado hazardous waste management regulations are similar to the federal requirements, both the federal and state regulatory citations are provided for reference purposes and to denote that both federal and state requirements were considered in establishing the identifying the ARAR requirement adopted for the remediation of the RFETS. Only substantive portions of the regulations are required under CERCLA actions for onsite activities.			
Closure Minimizes the need for further maintenance	6 CCR 1007-3 Part 265, Subpart G [40 CFR 265, Subpart G] .111(a)	A	The final cover will be designed to stabilize the hill slope with minimum maintenance.
Controls, minimizes, or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface water or to the atmosphere.	.111(b)	A	The final cover will be designed to stabilize the hill slope. The cover will also help to minimize migration of potentially contaminated water, post-closure escape of hazardous constituents, and hazardous waste decomposition products to the ground or surface water or to the atmosphere.
Complies with closure requirements in 265.310	.111(c)	A	This action will comply with, to the extent practicable, the substantive ARARs identified in this table for .310.
CLOSURE	6 CCR 1007-3, Part 265, Subpart N (40CFR		

Appendix A – Applicable or Relevant and Appropriate Requirements

Requirement	Citation	Type	Comment
SOLID WASTE DISPOSAL ACT (aka: Resource Conservation and Recovery Act [RCRA]), 42 USC 6901 *et seq.*; SUBTITLE C: HAZARDOUS WASTE MANAGEMENT (Colorado Hazardous Waste Act [CHWA]), CRS 25-15-101 to -217			
• Cover requirements (Landfills)	265, Subpart N)		
Function with minimum maintenance;	.310(a)(2)	A/C	Final cover will be designed to stabilize the hill slope with minimum maintenance.
Promote drainage and minimize erosion of abrasion of the cover	.310(a)(3)	A/C	Final cover will be designed to promote drainage on the surface of the cover and will thereby reduce erosion or abrasion of the cover.
Accommodate settling and Subsidence so that the cover's integrity is maintained.	.310(a)(4)	A/C	Final cover will be designed to accommodate settling and subsidence to maintain the cover's integrity.
FEDERAL NOXIOUS WEED ACT (Pub. L. 93-629; 7 USC 2814 *et seq.*)			
MANAGEMENT OF UNDESIRABLE PLANTS ON FEDERAL LANDS	7 USC 2814		
• Duties of Federal Agencies	(a)(3), (a)(4), (c)(1), (c)(2)	A	Federal agencies must complete and implement cooperative agreements with State agencies regarding the management of undesirable plant species on Federal lands under the agency's jurisdiction and establish integrated management systems to control or contain undesirable plant species targeted under cooperative agreements.
COLORADO NOXIOUS WEED ACT (CRS 35-5.5-101 *et seq.*)			
DUTY TO MANAGE NOXIOUS WEEDS	Section 104	A	It is the duty of all persons to use integrated methods to manage noxious weeds if the same are likely to be materially damaging to the land of neighboring landowners, and it is the duty of local governing bodies to assure that these plants are, in fact, managed.
COOPERATION WITH FEDERAL AND STATE AGENCIES	Section 111	A	The local governing bodies in Colorado are authorized to enter into cooperative agreements with federal and state agencies for the integrated management of noxious weeds within their respective territorial jurisdictions. The Jefferson County Noxious Weed Management Plan establishes the countywide strategy for the management, control, and eradication of noxious weeds in the County.

A – Action-Specific ARAR; C- Chemical-Specific ARAR; L – Location-Specific ARAR; TBC – To Be Considered

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Appendix A – Applicable or Relevant and Appropriate Requirements

Requirement	Citation	Type	Comment
NATIONAL WILDLIFE REFUGE ACT			
NATIONAL WILDLIFE REFUGE SYSTEM ADMINISTRATION ACT	16 USC 668 et seq.	L	Relevant and Appropriate. Prohibits interference with natural growth or wildlife, on National Wildlife Refuges administered by the USFWS, unless permitted.
COLORADO BASIC STANDARDS AND METHODOLOGIES FOR SURFACE WATER			
BASIC STANDARDS APPLICABLE TO SURFACE WATERS OF THE STATE	5CCR 1002-31	C/L	A basis for performance monitoring of surface water and groundwater.

A – Action-Specific ARAR; C- Chemical-Specific ARAR; L – Location-Specific ARAR; TBC – To Be Considered

Appendix B

Post-Accelerated Action Monitoring and Long-Term Surveillance and Maintenance Considerations

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POST-ACCELERATED ACTION MONITORING AND LONG-TERM SURVEILLANCE AND MONITORING CONSIDERATIONS

The objective of this section is to identify post-accelerated action monitoring and post-closure care requirements of the proposed accelerated action for the Original Landfill. These requirements are necessary for the long-term effectiveness of this remedy and include the following components: compliance with the Colorado Hazardous Waste Act (CHWA) post-closure requirements of 6 Colorado Code of Regulations (CCR) 1007-3, Part 265; information management; periodic review; and administrative jurisdiction. Other requirements necessary for the short- and long-term effectiveness of the remedy are identified in this Appendix, including institutional controls, inspection and maintenance, and environmental monitoring. These requirements are specific to the accelerated actions described in this IM/IRA and are summarized in Table 1. Additionally, these requirements will ultimately be captured (along with post-closure care requirements from other accelerated actions at Rocky Flats) in post-closure regulatory documents, which may include the final Corrective Action Decision/Record of Decision (CAD/ROD) for Rocky Flats, any post-closure Rocky Flats Cleanup Agreement (RFCA)-type agreement, and any post-closure Resource Conservation and Recovery Act (RCRA) permit (or other enforceable mechanism). DOE and CDPHE have not reached agreement as to whether a post-closure permit or, alternatively, an enforceable document as defined in 6 CCR 1007-3, Section 100.10(d) will be required for Rocky Flats, and if so, what requirements that permit or enforceable document will contain. The Parties will endeavor to resolve this matter. Failing an agreed-upon solution, each Party reserves its rights as provided in RFCA Part 18. Further, absent resolution of this matter consistent with the State Covenants Law, the CDPHE reserves the right to require a post-closure permit.

1.0 POST ACCELERATED ACTION CARE REQUIREMENTS

Post-closure controls, monitoring, and maintenance requirements for the cover described in this Appendix will be implemented at the Original Landfill. Some of these requirements are also the subject of an environmental covenant for the site if it is determined that Colorado's law applies to the federal government (see Section 25-15-320, C.R.S.).

The RFCA Parties have not reached agreement on the applicability of the statute to the federal government. Failing an agreed-upon resolution, each Party reserves its rights as provided in RFCA Part 18. 6 CCR 1007-3 Part 265.310(b) details the maintenance and monitoring requirements that must be implemented throughout the post-closure care period. The regulations establish 30 years as the default post-closure care period. However, the Colorado Department of Public Health and Environment (CDPHE) has the authority to increase or decrease this time period, as appropriate. The following requirements consistent with Part 265.310(b) will be imposed in the post-closure permit or other enforceable mechanisms implemented for the Original Landfill:

- Maintain the integrity and effectiveness of the final cover, including making repairs to the cover as necessary to correct the effects of settling, subsidence, erosion, or other events;

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- Maintain and monitor the groundwater monitoring system and comply with all other appropriate groundwater monitoring requirements; and

- Prevent run-on and run-off from eroding or otherwise damaging the final cover.

Each of these three requirements is discussed further below.

1.1 Maintain Integrity and Effectiveness of the Final Cover

Current Sitewide security and access controls will be maintained until completion of the Rocky Flats Environment Technology Site (RFETS or Site) Closure Project. Additional institutional controls related to maintaining the integrity and effectiveness of the final cover are identified in the IM/IRA and summarized in Table 1.

Following construction of the cover and toe buttress, monitoring and maintenance activities will be performed quarterly. The cover and toe buttress will be inspected for signs of erosion, differential settling, subsidence, burrowing animals, weeds, and seepage areas. Signs of potential problems include, but are not limited to, deep rooting vegetation (trees), ponded water on the surface, and surface depressions.

Routine maintenance of the cover and toe buttress will include filling in and regrading any depressions, burrowing animal holes, or other disturbances. Where excessive erosion has occurred, soil will be replaced with similar cover soil and re-seeded. After restoration of the cover, the area prone to excessive erosion will be protected further with structural erosion controls such as erosion mats, silt fences, straw-bale sediment barriers, and straw-bale check dams. These controls will be installed and maintained as necessary to limit sediment transport.

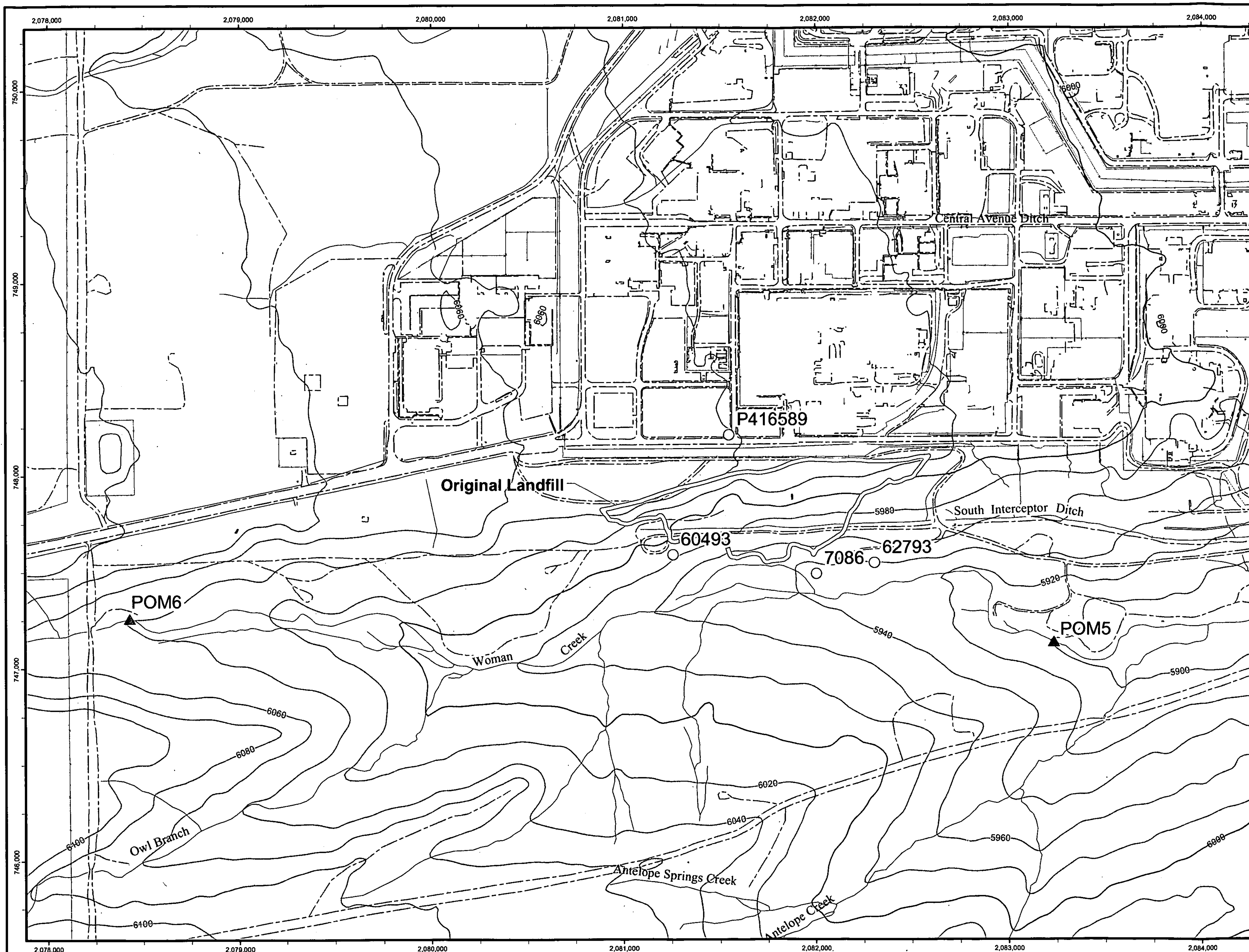
Special attention will be provided on the slope of the landfill to monitor for any sloughing or movement. Monuments may be installed to monitor OLF movement.

Repairs and routine maintenance will be made to maintain the integrity and effectiveness of the cover, including the toe buttress. Inspection results, repairs, and routine maintenance will be documented in annual reports to the regulatory agencies which may be combined with future Sitewide maintenance and monitoring reports.

1.2 Maintain and Monitor the Groundwater Monitoring System

A groundwater monitoring system will (6 CCR 1007-3; 265, Subpart F) be implemented after construction of the accelerated action is complete. A total of four (one upgradient and three downgradient) groundwater monitoring wells will be established for the Original Landfill as shown in Figure 1.0. These wells will be designated as RCRA groundwater monitoring wells. The effects of the accelerated action including changes in surface water and groundwater flow may occur which could impact the groundwater quality. The constituents that will be monitored are volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, and metals (including uranium). The purpose of this monitoring is to evaluate upgradient versus downgradient groundwater quality at the Original Landfill. Groundwater sampling results will be evaluated in accordance with the FY2005 IMP processes and procedures (see Table 1).

Proposed Groundwater and Surface Water Monitoring at the Original Landfill



Legend

- ○ Groundwater monitoring well
- ▲ Surface water monitoring location
- Landfill boundary

Standard Map Features

- Lake or pond
- Stream, ditch, or other drainage feature
- Paved road
- Dirt road
- Trail
- Fence
- Topographic contour (20 foot)

N

Scale = 1 : 6,000
1 inch represents 500 feet

500 0 500

Scale in Feet

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by: URS

Prepared for: KAISER-HILL

March 16, 2005

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In addition, the downgradient monitoring well sample results will be compared to the RFCA Surface Water Standards (RFCA Attachment 5, Section 3.0) consistent with Colorado Basic Standards and Methodologies for Surface Water and in accordance with the FY2005 IMP processes and procedures (see Table 1).

Upstream and downstream surface water quality will be monitored at the Original Landfill. Upstream and downstream surface water monitoring sampling stations are located on Figure 1.0. The surface water at these locations will be monitored for VOCs and metals (including uranium) to evaluate upstream and downstream surface water quality in accordance with the FY2005 IMP processes and procedures.

1.3 Prevent Run-on and Run-off from Eroding or Damaging the Cover

Berms and swales will be designed to divert stormwater (flowing from the north) around the Original Landfill. The landfill will be graded to allow positive surface water drainage from the cover. Erosion of the cover and toe buttress from storm or wind events is extremely unlikely but will be monitored as part of the routine inspections of the cover. In addition, groundwater that is drained by the toe buttress drain will infiltrate into the existing groundwater system at the southern boundary of the OLF. This will prevent a build-up of water behind the toe buttress.

Following construction of the cover, inspection and maintenance activities of the run-on and run-off controls will be performed quarterly. Berms and swales will be visually inspected for signs of erosion and unwanted vegetation. Routine maintenance, as necessary, includes repairing areas with soil erosion blankets and reseeding.

Routine maintenance will be conducted to prevent run-on and run-off from eroding or damaging the cover and toe buttress. Inspection results, repairs, and routine maintenance will be documented in annual reports to the regulatory agencies which may be combined with future Sitewide maintenance and monitoring reports.

2.0 INFORMATION MANAGEMENT

A successful stewardship program is dependent on retaining the necessary records about the history and residual contamination of the site. Retained information should include the history of the site, environmental data, selected remedies, use of controls and their associated monitoring and maintenance records, and any other information judged necessary for succeeding generations to understand the nature and extent of the residual contamination. At a minimum, the following records will be retained, stored, and retrievable for this accelerated action:

- This IM/IRA and any future modifications;
- The final design for the regraded surface, soil cover, buttress fill and surface drainage, and field change requests;
- The as-built drawings of the accelerated action;
- The monitoring and maintenance manual and subsequent revisions;
- Inspection records and logbooks;
- Maintenance records and logbooks;

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- Annual performance assessment reports;
- Analytical Data;
- CERCLA 5-year review reports;
- Correspondence involving the regulatory agencies associated with modifications to the post-accelerated action care regime;
- The Memorandum of Understanding (MOU) between DOE and the U.S. Department of Interior (DOI) (identifying the controlling authority);
- The CAD/ROD; and
- The RFETS HRR and other relevant historical documentation.

This information will be maintained in the Administrative Record (AR) File. Currently, the AR File is maintained onsite. DOE is currently looking at options for retention of permanent records following Site closure.

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Table 1
Summary of OLF Post-Accelerated Action Monitoring, Maintenance, and Institutional Control Requirements

Area	Action	Frequency of Action	Criteria	Possible Follow-on Action
Cover	Visual Inspection	Quarterly	Differential Settling/Subsidence	Repair, as necessary.
			Erosion	Repair erosion areas with soil and rock, and reseed, as necessary.
			Unwanted Vegetation	Remove deep rooting trees or employ weed control measures, as necessary.
			Burrowing animals	Remove and repair damage, as necessary.
Berms and Swales	Visual Inspection	Quarterly	Erosion	Repair erosion areas with soil, erosion blankets and reseeding, as necessary.
			Unwanted Vegetation	Remove deep rooting trees or employ weed control measures, as necessary.
Surface Water Sampling Stations	Sampling	Quarterly	Analyze for VOCs and metals (including uranium). Effluent limitations are the surface water standards. (RFCA Attachment 5, Table 1)	If a surface water standard is exceeded, sampling will increase to monthly for three consecutive months. If exceedances continue, the RFCA Parties will consult to determine whether a change in the remedy is required; additional parameters need to be analyzed; or if a different sampling frequency is required.
Groundwater	Sampling	Quarterly	Groundwater will be analyzed for VOCs, SVOCs, pesticides, and metals (including uranium). A. Increasing trend in constituents in downgradient versus upgradient groundwater monitoring wells. B. Downgradient monitoring well results compared to surface water standards: 1. 85th percentile of data greater than surface water standards, and 2. Significant increasing trend at 95%	If either criteria A or B condition exists, initiate consultation between the RFCA parties.

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Area	Action	Frequency of Action	Criteria	Possible Follow-on Action
			confidence	
Institutional and Physical Controls	Visual Inspection	Quarterly	Security and Access Controls; and overall site conditions	Check signs, fences (if required), markers, and overall condition of the OLF site to determine continuing effectiveness of institutional and physical controls.

3.0 PERIODIC ASSESSMENTS

Periodic assessments are performed to determine whether the selected accelerated actions and controls continue to operate as designed, and ascertain whether new technologies might exist to eliminate remaining residual contamination in a safe and cost-effective manner. The CERCLA 5-year review process is required for all Superfund sites that leave residual contamination behind after closure, and establishes the minimum requirements for post-closure periodic assessments. The EPA Comprehensive Five-Year Review Guidance (2001) describes the format of the review and suggests mechanisms that can be implemented through the 5-year review process to ensure the protectiveness of the remedy.

DOE is responsible for conducting the five-year reviews. EPA then issues a finding of concurrence or nonconcurrence. The public has indicated an interest in performing reviews more frequently than the 5-year interval specified in CERCLA. DOE intends to work with its stakeholders to arrive at a review regimen that meets community needs.

The periodic assessment will include actions such as evaluating monitoring and maintenance records, verifying regulatory compliance, and determining whether land use assumptions are still valid. Specific topics for the periodic assessment for the OLF are likely to include cover performance, landfill stability, surface water quality, and groundwater quality; as well as the need to continue monitoring.

4.0 CONTROLLING AUTHORITY

Long-term protection of human health and the environment necessitates that a controlling authority be established with responsibility for post-closure management. CERCLA mandates that DOE, as a responsible party, will retain responsibility for the contamination at RFETS resulting from its activities there, as well as responsibility for long-term maintenance of any remedies. The Rocky Flats National Wildlife Refuge Act of 2001 requires that, following certification by EPA that the cleanup and closure of Rocky Flats has been completed, certain lands of the current Site will be transferred from the Secretary of Energy to the Secretary of the Interior. These lands will be under administrative jurisdiction of the USFWS. The Act also requires the Secretary of Energy to retain administrative jurisdiction over Site lands required to carry out response actions required for the cleanup and closure of the Site. The MOU currently being negotiated between DOE and DOI will outline this process, although it is unlikely the final boundaries of the land to be transferred will be determined until the final cleanup and closure plans are approved. However, the OLF will remain under the administrative jurisdiction of the Secretary of Energy.

5.0 REPORTING REQUIREMENTS

Annual reporting of data results, inspection results, repairs, and routine maintenance will be required. These requirements may be combined into one report and/or with future Sitewide maintenance and monitoring reports.

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Appendix C

Environmental Data Summary Tables

Table 1.
Sampling and Analytical Summary for OLF Soil

Surface Soil			Subsurface Soil				
Location Code	Collection Date	Analyte Group	Location Code	Collection Date	Start Depth	End Depth	Analyte Group
INT. DITCH	8/8/1990	Metal	50592	12/15/1992	1.75	2	VOC
INT. DITCH	8/8/1990	PCB	50592	12/15/1992	3.75	4	VOC
INT. DITCH	8/8/1990	Pesticide	50592	12/15/1992	0	6	Metal
INT. DITCH	8/8/1990	SVOC	50592	12/15/1992	0	6	PCB
INT. DITCH	8/8/1990	VOC	50592	12/15/1992	0	6	Pesticide
SS505093	7/1/1993	Radionuclide	50592	12/15/1992	0	6	Radionuclide
SS505293	6/24/1993	Radionuclide	50592	12/15/1992	0	6	SVOC
SS505393	6/21/1993	Radionuclide	50592	12/15/1992	0	6	VOC
SS505493	6/30/1993	Radionuclide	50592	12/15/1992	4	6	VOC
SS505593	6/21/1993	Radionuclide	50592	12/15/1992	6	8	VOC
SS505693	6/21/1993	Radionuclide	50592	12/15/1992	8	10	VOC
SS505893	6/24/1993	Radionuclide	50592	12/15/1992	6	12	Metal
SS506293	1/8/1993	Metal	50592	12/15/1992	6	12	PCB
SS506293	1/8/1993	PCB	50592	12/15/1992	6	12	Pesticide
SS506293	1/8/1993	Pesticide	50592	12/15/1992	6	12	Radionuclide
SS506293	1/8/1993	Radionuclide	50592	12/15/1992	6	12	SVOC
SS506293	1/8/1993	SVOC	50592	12/15/1992	6	12	VOC
SS506293	1/8/1993	VOC	50592	12/15/1992	10	12	VOC
SS506493	1/8/1993	Metal	50592	12/15/1992	12	14	VOC
SS506493	1/8/1993	PCB	50592	12/15/1992	14	16	VOC
SS506493	1/8/1993	Pesticide	50592	12/15/1992	12	18	Metal
SS506493	1/8/1993	Radionuclide	50592	12/15/1992	12	18	PCB
SS506493	1/8/1993	SVOC	50592	12/15/1992	12	18	Pesticide
SS506493	1/8/1993	VOC	50592	12/15/1992	12	18	Radionuclide
SS506593	1/25/1993	Metal	50592	12/15/1992	12	18	SVOC
SS506593	1/25/1993	PCB	50592	12/15/1992	12	18	VOC
SS506593	1/25/1993	Pesticide	50592	12/15/1992	16	18	VOC
SS506593	1/25/1993	Radionuclide	50592	12/15/1992	18	20	VOC
SS506593	1/25/1993	SVOC	50592	12/15/1992	20	22	VOC
SS506593	1/25/1993	VOC	50592	12/15/1992	18	24	Metal
SS506693	1/25/1993	Metal	50592	12/15/1992	18	24	PCB
SS506693	1/25/1993	PCB	50592	12/15/1992	18	24	Pesticide
SS506693	1/25/1993	Pesticide	50592	12/15/1992	18	24	Radionuclide
SS506693	1/25/1993	Radionuclide	50592	12/15/1992	18	24	SVOC
SS506693	1/25/1993	SVOC	50592	12/15/1992	18	24	VOC
SS506693	1/25/1993	VOC	50592	12/15/1992	22	24	VOC
SS506793	1/15/1993	Metal	50592	12/15/1992	24	26	VOC
SS506793	1/15/1993	PCB	50592	12/15/1992	26	28	VOC
SS506793	1/15/1993	Pesticide	50592	12/16/1992	0	32	Metal
SS506793	1/15/1993	Radionuclide	50592	12/16/1992	0	32	PCB
SS506793	1/15/1993	SVOC	50592	12/16/1992	0	32	Pesticide
SS506793	1/15/1993	VOC	50592	12/16/1992	0	32	Radionuclide
SS506893	1/15/1993	Metal	50592	12/16/1992	0	32	SVOC
SS506893	1/15/1993	PCB	50592	12/16/1992	0	32	VOC
SS506893	1/15/1993	Pesticide	50692	12/8/1992	0	2	VOC
SS506893	1/15/1993	Radionuclide	50692	12/8/1992	0	4	VOC
SS506893	1/15/1993	SVOC	50692	12/8/1992	0	6	Metal
SS506893	1/15/1993	VOC	50692	12/8/1992	0	6	PCB
SS507093	1/25/1993	Metal	50692	12/8/1992	0	6	Pesticide
SS507093	1/25/1993	PCB	50692	12/8/1992	0	6	Radionuclide
SS507093	1/25/1993	Pesticide	50692	12/8/1992	0	6	SVOC
SS507093	1/25/1993	Radionuclide	50692	12/8/1992	0	6	VOC
SS507093	1/25/1993	SVOC	50692	12/8/1992	4	6	VOC
SS507093	1/25/1993	VOC	50692	12/8/1992	6	8	VOC
SS507193	1/25/1993	Metal	50692	12/8/1992	8	10	VOC

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SS507193	1/25/1993	PCB	50692	12/9/1992	6	12	Metal
SS507193	1/25/1993	Pesticide	50692	12/9/1992	6	12	PCB
SS507193	1/25/1993	Radionuclide	50692	12/9/1992	6	12	Pesticide
SS507193	1/25/1993	SVOC	50692	12/9/1992	6	12	Radionuclide
SS507193	1/25/1993	VOC	50692	12/9/1992	6	12	SVOC
SS507293	1/25/1993	Metal	50692	12/9/1992	6	12	VOC
SS507293	1/25/1993	PCB	50692	12/9/1992	10	12	VOC
SS507293	1/25/1993	Pesticide	50692	12/9/1992	12	14	VOC
SS507293	1/25/1993	Radionuclide	50692	12/9/1992	14	16	VOC
SS507293	1/25/1993	SVOC	50692	12/10/1992	0	14	Metal
SS507293	1/25/1993	VOC	50692	12/10/1992	0	14	PCB
SS507393	1/20/1993	Metal	50692	12/10/1992	0	14	Pesticide
SS507393	1/20/1993	PCB	50692	12/10/1992	0	14	Radionuclide
SS507393	1/20/1993	Pesticide	50692	12/10/1992	0	14	SVOC
SS507393	1/20/1993	Radionuclide	50692	12/10/1992	0	14	VOC
SS507393	1/20/1993	SVOC	50792	12/11/1992	0	2	VOC
SS507393	1/20/1993	VOC	50792	12/11/1992	0	4	VOC
SS507493	1/25/1993	Metal	50792	12/11/1992	0	6	Metal
SS507493	1/25/1993	PCB	50792	12/11/1992	0	6	PCB
SS507493	1/25/1993	Pesticide	50792	12/11/1992	0	6	Pesticide
SS507493	1/25/1993	Radionuclide	50792	12/11/1992	0	6	Radionuclide
SS507493	1/25/1993	SVOC	50792	12/11/1992	0	6	SVOC
SS507493	1/25/1993	VOC	50792	12/11/1992	0	6	VOC
SS507593	1/25/1993	Metal	50792	12/11/1992	4	6	VOC
SS507593	1/25/1993	PCB	50792	12/11/1992	6	8	VOC
SS507593	1/25/1993	Pesticide	50792	12/11/1992	0	10	Metal
SS507593	1/25/1993	Radionuclide	50792	12/11/1992	0	10	PCB
SS507593	1/25/1993	SVOC	50792	12/11/1992	0	10	Pesticide
SS507593	1/25/1993	VOC	50792	12/11/1992	0	10	Radionuclide
SS507693	1/20/1993	Metal	50792	12/11/1992	0	10	SVOC
SS507693	1/20/1993	PCB	50792	12/11/1992	0	10	VOC
SS507693	1/20/1993	Pesticide	50792	12/11/1992	8	10	VOC
SS507693	1/20/1993	Radionuclide	50892	12/14/1992	0	2	VOC
SS507693	1/20/1993	SVOC	50892	12/14/1992	2	4	VOC
SS507693	1/20/1993	VOC	50892	12/14/1992	0	6	Metal
SS507793	1/26/1993	Metal	50892	12/14/1992	0	6	PCB
SS507793	1/26/1993	PCB	50892	12/14/1992	0	6	Pesticide
SS507793	1/26/1993	Pesticide	50892	12/14/1992	0	6	Radionuclide
SS507793	1/26/1993	Radionuclide	50892	12/14/1992	0	6	SVOC
SS507793	1/26/1993	SVOC	50892	12/14/1992	0	6	VOC
SS507793	1/26/1993	VOC	50892	12/14/1992	4	6	VOC
SS507893	1/26/1993	Metal	50892	12/14/1992	6	8	VOC
SS507893	1/26/1993	PCB	50892	12/14/1992	8	10	VOC
SS507893	1/26/1993	Pesticide	50892	12/14/1992	6	12	Metal
SS507893	1/26/1993	Radionuclide	50892	12/14/1992	6	12	PCB
SS507893	1/26/1993	SVOC	50892	12/14/1992	6	12	Pesticide
SS507893	1/26/1993	VOC	50892	12/14/1992	6	12	Radionuclide
SS507993	1/26/1993	Metal	50892	12/14/1992	6	12	SVOC
SS507993	1/26/1993	PCB	50892	12/14/1992	6	12	VOC
SS507993	1/26/1993	Pesticide	50892	12/14/1992	10	12	VOC
SS507993	1/26/1993	Radionuclide	50892	12/14/1992	8	16	Metal
SS507993	1/26/1993	SVOC	50892	12/14/1992	8	16	PCB
SS507993	1/26/1993	VOC	50892	12/14/1992	8	16	Pesticide
SS508093	1/27/1993	Metal	50892	12/14/1992	8	16	Radionuclide
SS508093	1/27/1993	PCB	50892	12/14/1992	8	16	SVOC
SS508093	1/27/1993	Pesticide	50892	12/14/1992	8	16	VOC
SS508093	1/27/1993	Radionuclide	50992	12/18/1992	0	2	VOC

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SS508093	1/27/1993	SVOC	50992	12/18/1992	0	6	Metal
SS508093	1/27/1993	VOC	50992	12/18/1992	0	6	PCB
SS508193	1/20/1993	Metal	50992	12/18/1992	0	6	Pesticide
SS508193	1/20/1993	PCB	50992	12/18/1992	0	6	Radionuclide
SS508193	1/20/1993	Pesticide	50992	12/18/1992	0	6	SVOC
SS508193	1/20/1993	Radionuclide	50992	12/18/1992	0	6	VOC
SS508193	1/20/1993	SVOC	50992	12/18/1992	4	6	VOC
SS508193	1/20/1993	VOC	50992	12/18/1992	6	8	VOC
SS508293	1/26/1993	Metal	50992	12/18/1992	8	10	VOC
SS508293	1/26/1993	PCB	50992	12/18/1992	6	12	Metal
SS508293	1/26/1993	Pesticide	50992	12/18/1992	6	12	PCB
SS508293	1/26/1993	Radionuclide	50992	12/18/1992	6	12	Pesticide
SS508293	1/26/1993	SVOC	50992	12/18/1992	6	12	Radionuclide
SS508293	1/26/1993	VOC	50992	12/18/1992	6	12	SVOC
SS508393	1/26/1993	Metal	50992	12/18/1992	6	12	VOC
SS508393	1/26/1993	PCB	50992	12/18/1992	12	14	VOC
SS508393	1/26/1993	Pesticide	50992	12/18/1992	0	16	Metal
SS508393	1/26/1993	Radionuclide	50992	12/18/1992	0	16	PCB
SS508393	1/26/1993	SVOC	50992	12/18/1992	0	16	Pesticide
SS508393	1/26/1993	VOC	50992	12/18/1992	0	16	Radionuclide
SS508493	1/26/1993	Metal	50992	12/18/1992	0	16	SVOC
SS508493	1/26/1993	PCB	50992	12/18/1992	0	16	VOC
SS508493	1/26/1993	Pesticide	50992	12/18/1992	14	16	VOC
SS508493	1/26/1993	Radionuclide	51092	12/21/1992	0	2	VOC
SS508493	1/26/1993	SVOC	51092	12/21/1992	2	4	VOC
SS508493	1/26/1993	VOC	51092	12/21/1992	0	6	Metal
SS508593	1/27/1993	Metal	51092	12/21/1992	0	6	PCB
SS508593	1/27/1993	PCB	51092	12/21/1992	0	6	Pesticide
SS508593	1/27/1993	Pesticide	51092	12/21/1992	0	6	Radionuclide
SS508593	1/27/1993	Radionuclide	51092	12/21/1992	0	6	SVOC
SS508593	1/27/1993	SVOC	51092	12/21/1992	0	6	VOC
SS508593	1/27/1993	VOC	51092	12/21/1992	4	6	VOC
SS508693	1/21/1993	Metal	51092	12/21/1992	6	8	VOC
SS508693	1/21/1993	PCB	51092	12/21/1992	0	12	Metal
SS508693	1/21/1993	Pesticide	51092	12/21/1992	0	12	PCB
SS508693	1/21/1993	Radionuclide	51092	12/21/1992	0	12	Pesticide
SS508693	1/21/1993	SVOC	51092	12/21/1992	0	12	Radionuclide
SS508693	1/21/1993	VOC	51092	12/21/1992	0	12	SVOC
SS508793	2/1/1993	Metal	51092	12/21/1992	0	12	VOC
SS508793	2/1/1993	PCB	57594	10/31/1994	1.7	2	VOC
SS508793	2/1/1993	Pesticide	57594	10/31/1994	3.7	4	VOC
SS508793	2/1/1993	Radionuclide	57594	10/31/1994	0	6	Metal
SS508793	2/1/1993	SVOC	57594	10/31/1994	0	6	PCB
SS508793	2/1/1993	VOC	57594	10/31/1994	0	6	Pesticide
SS508893	1/26/1993	Metal	57594	10/31/1994	0	6	Radionuclide
SS508893	1/26/1993	PCB	57594	10/31/1994	0	6	SVOC
SS508893	1/26/1993	Pesticide	57594	10/31/1994	0	6	VOC
SS508893	1/26/1993	Radionuclide	57594	10/31/1994	5.7	6	VOC
SS508893	1/26/1993	SVOC	57594	10/31/1994	7.7	8	VOC
SS508893	1/26/1993	VOC	57594	10/31/1994	6	12	Metal
SS508993	1/27/1993	Metal	57594	10/31/1994	6	12	PCB
SS508993	1/27/1993	PCB	57594	10/31/1994	6	12	Pesticide
SS508993	1/27/1993	Pesticide	57594	10/31/1994	6	12	Radionuclide
SS508993	1/27/1993	Radionuclide	57594	10/31/1994	6	12	SVOC
SS508993	1/27/1993	SVOC	57594	10/31/1994	6	12	VOC
SS508993	1/27/1993	VOC	57594	10/31/1994	15.7	16	VOC
SS509093	2/2/1993	Metal	57594	11/4/1994	18	23	Metal

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SS509093	2/2/1993	PCB	57594	11/4/1994	18	23	PCB
SS509093	2/2/1993	Pesticide	57594	11/4/1994	18	23	Pesticide
SS509093	2/2/1993	Radionuclide	57594	11/4/1994	18	23	Radionuclide
SS509093	2/2/1993	SVOC	57594	11/4/1994	18	23	SVOC
SS509093	2/2/1993	VOC	57594	11/4/1994	18	23	VOC
SS509193	1/21/1993	Metal	57594	11/7/1994	18	23	Metal
SS509193	1/21/1993	PCB	57594	11/7/1994	18	23	PCB
SS509193	1/21/1993	Pesticide	57594	11/7/1994	18	23	Pesticide
SS509193	1/21/1993	Radionuclide	57594	11/7/1994	18	23	Radionuclide
SS509193	1/21/1993	SVOC	57594	11/7/1994	18	23	SVOC
SS509193	1/21/1993	VOC	57594	11/7/1994	18	23	VOC
SS509293	2/1/1993	Metal	57594	11/8/1994	84.9	90.4	Metal
SS509293	2/1/1993	PCB	57594	11/8/1994	84.9	90.4	PCB
SS509293	2/1/1993	Pesticide	57594	11/8/1994	84.9	90.4	Pesticide
SS509293	2/1/1993	Radionuclide	57594	11/8/1994	84.9	90.4	Radionuclide
SS509293	2/1/1993	SVOC	57594	11/8/1994	84.9	90.4	SVOC
SS509293	2/1/1993	VOC	57594	11/8/1994	84.9	90.4	VOC
SS509393	2/1/1993	Metal	57594	11/29/1994	24	105	Metal
SS509393	2/1/1993	PCB	57594	11/29/1994	24	105	PCB
SS509393	2/1/1993	Pesticide	57594	11/29/1994	24	105	Pesticide
SS509393	2/1/1993	Radionuclide	57594	11/29/1994	24	105	Radionuclide
SS509393	2/1/1993	SVOC	57594	11/29/1994	24	105	SVOC
SS509393	2/1/1993	VOC	57594	11/29/1994	24	105	VOC
SS509493	1/27/1993	Metal	58393	5/12/1993	3.25	3.5	VOC
SS509493	1/27/1993	PCB	58393	5/12/1993	0	6	Metal
SS509493	1/27/1993	Pesticide	58393	5/12/1993	0	6	PCB
SS509493	1/27/1993	Radionuclide	58393	5/12/1993	0	6	Pesticide
SS509493	1/27/1993	SVOC	58393	5/12/1993	0	6	Radionuclide
SS509493	1/27/1993	VOC	58393	5/12/1993	0	6	SVOC
SS509593	1/28/1993	Metal	58393	5/12/1993	0	6	VOC
SS509593	1/28/1993	PCB	58393	5/12/1993	6.45	6.7	VOC
SS509593	1/28/1993	Pesticide	58393	5/12/1993	10.4	10.7	VOC
SS509593	1/28/1993	Radionuclide	58393	5/12/1993	6	12.7	Metal
SS509593	1/28/1993	SVOC	58393	5/12/1993	6	12.7	PCB
SS509593	1/28/1993	VOC	58393	5/12/1993	6	12.7	Pesticide
SS509693	6/21/1993	Metal	58393	5/12/1993	6	12.7	Radionuclide
SS509693	6/21/1993	PCB	58393	5/12/1993	6	12.7	SVOC
SS509693	6/21/1993	Pesticide	58393	5/12/1993	6	12.7	VOC
SS509693	6/21/1993	Radionuclide	58393	5/12/1993	19.5	21.5	Metal
SS509693	6/21/1993	SVOC	58393	5/12/1993	19.5	21.5	Radionuclide
SS509693	6/21/1993	VOC	58393	5/12/1993	19.5	21.5	VOC
SS509793	1/21/1993	Metal	58493	5/13/1993	3.15	3.4	VOC
SS509793	1/21/1993	PCB	58493	5/13/1993	2	4	VOC
SS509793	1/21/1993	Pesticide	58493	5/13/1993	0	6	Metal
SS509793	1/21/1993	Radionuclide	58493	5/13/1993	0	6	PCB
SS509793	1/21/1993	SVOC	58493	5/13/1993	0	6	Pesticide
SS509793	1/21/1993	VOC	58493	5/13/1993	0	6	Radionuclide
SS509893	2/1/1993	Metal	58493	5/13/1993	0	6	SVOC
SS509893	2/1/1993	PCB	58493	5/13/1993	0	6	VOC
SS509893	2/1/1993	Pesticide	58493	5/13/1993	6	8	VOC
SS509893	2/1/1993	Radionuclide	58493	5/13/1993	8	10	VOC
SS509893	2/1/1993	SVOC	58493	5/13/1993	6	12	Metal
SS509893	2/1/1993	VOC	58493	5/13/1993	6	12	PCB
SS509993	2/1/1993	Metal	58493	5/13/1993	6	12	Pesticide
SS509993	2/1/1993	PCB	58493	5/13/1993	6	12	Radionuclide
SS509993	2/1/1993	Pesticide	58493	5/13/1993	6	12	SVOC
SS509993	2/1/1993	Radionuclide	58493	5/13/1993	6	12	VOC

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SS509993	2/1/1993	SVOC	58494	10/13/1994	2	2.5	VOC
SS509993	2/1/1993	VOC	58494	10/13/1994	4	4.5	VOC
SS510093	1/27/1993	Metal	58494	10/13/1994	0	6	Metal
SS510093	1/27/1993	PCB	58494	10/13/1994	0	6	PCB
SS510093	1/27/1993	Pesticide	58494	10/13/1994	0	6	Pesticide
SS510093	1/27/1993	Radionuclide	58494	10/13/1994	0	6	Radionuclide
SS510093	1/27/1993	SVOC	58494	10/13/1994	0	6	SVOC
SS510093	1/27/1993	VOC	58494	10/13/1994	0	6	VOC
SS510193	1/28/1993	Metal	58494	10/13/1994	6	6.5	VOC
SS510193	1/28/1993	PCB	58494	10/13/1994	8	8.5	VOC
SS510193	1/28/1993	Pesticide	58494	10/13/1994	6	9.5	Metal
SS510193	1/28/1993	Radionuclide	58494	10/13/1994	6	9.5	PCB
SS510293	6/21/1993	Metal	58494	10/13/1994	6	9.5	Pesticide
SS510293	6/21/1993	PCB	58494	10/13/1994	6	9.5	Radionuclide
SS510293	6/21/1993	Pesticide	58494	10/13/1994	6	9.5	SVOC
SS510293	6/21/1993	Radionuclide	58494	10/13/1994	6	9.5	VOC
SS510293	6/21/1993	SVOC	58494	10/13/1994	9.5	10	VOC
SS510293	6/21/1993	VOC	58593	5/14/1993	0	2	Metal
SS510393	1/21/1993	Metal	58593	5/14/1993	0	2	Radionuclide
SS510393	1/21/1993	PCB	58593	5/14/1993	0	2	VOC
SS510393	1/21/1993	Pesticide	58593	5/14/1993	2	4	VOC
SS510393	1/21/1993	Radionuclide	58593	5/14/1993	0	6	Metal
SS510393	1/21/1993	SVOC	58593	5/14/1993	0	6	PCB
SS510393	1/21/1993	VOC	58593	5/14/1993	0	6	Pesticide
SS510493	2/1/1993	Metal	58593	5/14/1993	0	6	Radionuclide
SS510493	2/1/1993	PCB	58593	5/14/1993	0	6	SVOC
SS510493	2/1/1993	Pesticide	58593	5/14/1993	0	6	VOC
SS510493	2/1/1993	Radionuclide	58593	5/14/1993	4	6	VOC
SS510493	2/1/1993	SVOC	58593	5/14/1993	6	8	VOC
SS510493	2/1/1993	VOC	58593	5/14/1993	8	10	VOC
SS510593	1/28/1993	Metal	58593	5/14/1993	6	12.5	Metal
SS510593	1/28/1993	PCB	58593	5/14/1993	6	12.5	PCB
SS510593	1/28/1993	Pesticide	58593	5/14/1993	6	12.5	Pesticide
SS510593	1/28/1993	Radionuclide	58593	5/14/1993	6	12.5	Radionuclide
SS510593	1/28/1993	SVOC	58593	5/14/1993	6	12.5	SVOC
SS510593	1/28/1993	VOC	58593	5/14/1993	6	12.5	VOC
SS510693	1/28/1993	Metal	58593	5/14/1993	10.5	12.5	VOC
SS510693	1/28/1993	PCB	58593	5/14/1993	12.5	14.1	VOC
SS510693	1/28/1993	Pesticide	58593	5/14/1993	14.1	16.1	VOC
SS510693	1/28/1993	Radionuclide	58593	5/14/1993	12.5	18.1	Metal
SS510693	1/28/1993	SVOC	58593	5/14/1993	12.5	18.1	PCB
SS510693	1/28/1993	VOC	58593	5/14/1993	12.5	18.1	Pesticide
SS510793	1/28/1993	Metal	58593	5/14/1993	12.5	18.1	Radionuclide
SS510793	1/28/1993	PCB	58593	5/14/1993	12.5	18.1	SVOC
SS510793	1/28/1993	Pesticide	58593	5/14/1993	12.5	18.1	VOC
SS510793	1/28/1993	Radionuclide	58593	5/14/1993	16.1	18.1	VOC
SS510893	1/28/1993	Metal	58693	5/17/1993	0	2	Metal
SS510893	1/28/1993	PCB	58693	5/17/1993	0	2	Radionuclide
SS510893	1/28/1993	Pesticide	58693	5/17/1993	2	4	VOC
SS510893	1/28/1993	Radionuclide	58693	5/17/1993	0	6	Metal
SS510893	1/28/1993	SVOC	58693	5/17/1993	0	6	PCB
SS510893	1/28/1993	VOC	58693	5/17/1993	0	6	Pesticide
SS510993	2/2/1993	Metal	58693	5/17/1993	0	6	Radionuclide
SS510993	2/2/1993	PCB	58693	5/17/1993	0	6	SVOC
SS510993	2/2/1993	Pesticide	58693	5/17/1993	0	6	VOC
SS510993	2/2/1993	Radionuclide	58693	5/17/1993	6.2	8.2	VOC
SS510993	2/2/1993	SVOC	58693	5/17/1993	6	12	Metal

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SS510993	2/2/1993	VOC	58693	5/17/1993	6	12	PCB
SS511093	2/2/1993	Metal	58693	5/17/1993	6	12	Pesticide
SS511093	2/2/1993	PCB	58693	5/17/1993	6	12	Radionuclide
SS511093	2/2/1993	Pesticide	58693	5/17/1993	6	12	SVOC
SS511093	2/2/1993	Radionuclide	58693	5/17/1993	6	12	VOC
SS511093	2/2/1993	SVOC	58693	5/17/1993	10.3	12	VOC
SS511093	2/2/1993	VOC	58693	5/18/1993	15.5	17.5	VOC
SS511193	2/2/1993	Metal	58693	5/18/1993	12	19.5	Metal
SS511193	2/2/1993	PCB	58693	5/18/1993	12	19.5	PCB
SS511193	2/2/1993	Pesticide	58693	5/18/1993	12	19.5	Pesticide
SS511193	2/2/1993	Radionuclide	58693	5/18/1993	12	19.5	Radionuclide
SS511193	2/2/1993	SVOC	58693	5/18/1993	12	19.5	SVOC
SS511193	2/2/1993	VOC	58693	5/18/1993	12	19.5	VOC
SS511293	2/2/1993	Metal	58693	5/18/1993	19.8	20.1	VOC
SS511293	2/2/1993	PCB	58693	5/18/1993	21.5	23.5	VOC
SS511293	2/2/1993	Pesticide	58693	5/18/1993	19.5	25.5	Metal
SS511293	2/2/1993	Radionuclide	58693	5/18/1993	19.5	25.5	PCB
SS511293	2/2/1993	SVOC	58693	5/18/1993	19.5	25.5	Pesticide
SS511293	2/2/1993	VOC	58693	5/18/1993	19.5	25.5	Radionuclide
SS511493	2/2/1993	Metal	58693	5/18/1993	19.5	25.5	SVOC
SS511493	2/2/1993	PCB	58693	5/18/1993	19.5	25.5	VOC
SS511493	2/2/1993	Pesticide	58693	5/18/1993	23.5	25.5	VOC
SS511493	2/2/1993	Radionuclide	58693	5/18/1993	25.5	27.5	VOC
SS511493	2/2/1993	SVOC	58693	5/18/1993	25.5	29.5	Metal
SS511493	2/2/1993	VOC	58693	5/18/1993	25.5	29.5	PCB
SS515593	7/1/1993	Radionuclide	58693	5/18/1993	25.5	29.5	Pesticide
SS515693	7/1/1993	Radionuclide	58693	5/18/1993	25.5	29.5	Radionuclide
			58693	5/18/1993	25.5	29.5	SVOC
			58693	5/18/1993	25.5	29.5	VOC
			58693	5/18/1993	27.5	29.5	VOC
			59293	6/4/1993	0	2	Metal
			59293	6/4/1993	0	2	Radionuclide
			59293	6/4/1993	0	2	VOC
			59293	6/4/1993	2	4	VOC
			59293	6/4/1993	0	6	Metal
			59293	6/4/1993	0	6	PCB
			59293	6/4/1993	0	6	Pesticide
			59293	6/4/1993	0	6	Radionuclide
			59293	6/4/1993	0	6	SVOC
			59293	6/4/1993	0	6	VOC
			59293	6/4/1993	4	6	VOC
			59293	6/4/1993	6	8	VOC
			59293	6/4/1993	8	10	VOC
			59293	6/4/1993	6	12	Metal
			59293	6/4/1993	6	12	PCB
			59293	6/4/1993	6	12	Pesticide
			59293	6/4/1993	6	12	Radionuclide
			59293	6/4/1993	6	12	SVOC
			59293	6/4/1993	6	12	VOC
			59293	6/4/1993	10	12	VOC
			59293	6/4/1993	12	14	VOC
			59293	6/4/1993	12	18.9	Metal
			59293	6/4/1993	12	18.9	PCB
			59293	6/4/1993	12	18.9	Pesticide
			59293	6/4/1993	12	18.9	Radionuclide
			59293	6/4/1993	12	18.9	SVOC
			59293	6/4/1993	12	18.9	VOC

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59493	6/14/1993	0.4	2	Metal
59493	6/14/1993	0.4	2	Radionuclide
59493	6/14/1993	0.4	2	VOC
59493	6/14/1993	0	6.3	Metal
59493	6/14/1993	0	6.3	PCB
59493	6/14/1993	0	6.3	Pesticide
59493	6/14/1993	0	6.3	Radionuclide
59493	6/14/1993	0	6.3	SVOC
59493	6/14/1993	0	6.3	VOC
59493	6/14/1993	4.9	6.9	VOC
59493	6/14/1993	6.9	12.9	Metal
59493	6/14/1993	6.9	12.9	PCB
59493	6/14/1993	6.9	12.9	Pesticide
59493	6/14/1993	6.9	12.9	Radionuclide
59493	6/14/1993	6.9	12.9	SVOC
59493	6/14/1993	6.9	12.9	VOC
59493	6/14/1993	10.9	12.9	VOC
59493	6/14/1993	14.9	16.6	VOC
59493	6/14/1993	12.9	17.8	Metal
59493	6/14/1993	12.9	17.8	PCB
59493	6/14/1993	12.9	17.8	Pesticide
59493	6/14/1993	12.9	17.8	Radionuclide
59493	6/14/1993	12.9	17.8	SVOC
59493	6/14/1993	12.9	17.8	VOC
59593	6/15/1993	0	2	Metal
59593	6/15/1993	0	2	Radionuclide
59593	6/15/1993	0	2	VOC
59593	6/15/1993	0	6	Metal
59593	6/15/1993	0	6	PCB
59593	6/15/1993	0	6	Pesticide
59593	6/15/1993	0	6	Radionuclide
59593	6/15/1993	0	6	SVOC
59593	6/15/1993	0	6	VOC
59593	6/15/1993	4	6	VOC
59593	6/15/1993	6	8	VOC
59593	6/15/1993	8	10	VOC
59593	6/15/1993	6	12	Metal
59593	6/15/1993	6	12	PCB
59593	6/15/1993	6	12	Pesticide
59593	6/15/1993	6	12	Radionuclide
59593	6/15/1993	6	12	SVOC
59593	6/15/1993	6	12	VOC
59593	6/15/1993	10	12	VOC
59593	6/15/1993	14.4	16.4	Metal
59593	6/15/1993	14.4	16.4	PCB
59593	6/15/1993	14.4	16.4	Pesticide
59593	6/15/1993	14.4	16.4	Radionuclide
59593	6/15/1993	14.4	16.4	SVOC
59593	6/15/1993	14.4	16.4	VOC
59793	6/11/1993	0	2	Metal
59793	6/11/1993	0	2	Radionuclide
59793	6/11/1993	0	2	VOC
59793	6/11/1993	2	4	VOC
59793	6/11/1993	0	5.3	Metal
59793	6/11/1993	0	5.3	PCB
59793	6/11/1993	0	5.3	Pesticide
59793	6/11/1993	0	5.3	Radionuclide

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59793	6/11/1993	0	5.3	SVOC
59793	6/11/1993	0	5.3	VOC
59793	6/11/1993	5.3	7.3	VOC
59793	6/11/1993	7.3	9.3	VOC
59793	6/11/1993	5.3	11.3	Metal
59793	6/11/1993	5.3	11.3	PCB
59793	6/11/1993	5.3	11.3	Pesticide
59793	6/11/1993	5.3	11.3	Radionuclide
59793	6/11/1993	5.3	11.3	SVOC
59793	6/11/1993	5.3	11.3	VOC
59793	6/11/1993	9.3	11.3	VOC
59793	6/11/1993	13.3	15.3	Metal
59793	6/11/1993	13.3	15.3	PCB
59793	6/11/1993	13.3	15.3	Pesticide
59793	6/11/1993	13.3	15.3	Radionuclide
59793	6/11/1993	13.3	15.3	SVOC
59793	6/11/1993	13.3	15.3	VOC
60993	6/23/1993	0	2	VOC
60993	6/23/1993	2	4	VOC
60993	6/23/1993	0	6	Metal
60993	6/23/1993	0	6	PCB
60993	6/23/1993	0	6	Pesticide
60993	6/23/1993	0	6	Radionuclide
60993	6/23/1993	0	6	SVOC
60993	6/23/1993	0	6	VOC
60993	6/23/1993	4	6	VOC
60993	6/23/1993	6	8	VOC
61093	6/23/1993	2	4	VOC
61093	6/23/1993	4	6	VOC
61093	6/23/1993	6	8	VOC
61093	6/23/1993	8	10	VOC
61093	6/23/1993	6	13	Metal
61093	6/23/1993	6	13	PCB
61093	6/23/1993	6	13	Pesticide
61093	6/23/1993	6	13	Radionuclide
61093	6/23/1993	6	13	SVOC
61093	6/23/1993	6	13	VOC
61093	6/23/1993	12	13	VOC
63193	6/22/1993	0	2	VOC
63193	6/22/1993	2	4	VOC
63193	6/22/1993	0	6	Metal
63193	6/22/1993	0	6	Radionuclide
63193	6/22/1993	4	6	VOC
63193	6/22/1993	6	8	VOC
63193	6/22/1993	8	10	VOC
63193	6/22/1993	6	12	Metal
63193	6/22/1993	6	12	PCB
63193	6/22/1993	6	12	Pesticide
63193	6/22/1993	6	12	Radionuclide
63193	6/22/1993	6	12	SVOC
63193	6/22/1993	6	12	VOC
63193	6/22/1993	10	12	VOC
63193	6/22/1993	12	14	VOC
63193	6/22/1993	14	16	VOC
63193	6/22/1993	16	18	VOC
63193	6/22/1993	12	20	Metal
63193	6/22/1993	12	20	PCB

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	63193	6/22/1993	12	20	Pesticide
	63193	6/22/1993	12	20	Radionuclide
	63193	6/22/1993	12	20	SVOC
	63193	6/22/1993	12	20	VOC
	63193	6/22/1993	18	20	VOC

Table 2.
Sampling and Analytical Summary for OLF Groundwater

Analysis for Total Concentrations			Analysis for Dissolved Concentrations		
Location Code	Collection Date	Analyte Group	Location Code	Collection Date	Analyte Group
581	2/6/1992	Metal	581	2/6/1992	Metal
581	2/6/1992	Radionuclide	581	2/6/1992	Radionuclide
581	2/6/1992	VOC	10994	6/21/1994	Metal
581	2/6/1992	WQP	10994	9/2/1994	Metal
10994	6/21/1994	Metal	10994	11/30/1994	Metal
10994	6/21/1994	PCB	10994	2/8/1995	Metal
10994	6/21/1994	Pesticide	10994	2/8/1995	Radionuclide
10994	6/21/1994	SVOC	10994	5/24/1995	Metal
10994	6/21/1994	VOC	10994	5/24/1995	Radionuclide
10994	6/21/1994	WQP	10994	11/1/1995	Metal
10994	9/2/1994	PCB	10994	11/1/1995	Radionuclide
10994	9/2/1994	Pesticide	10994	3/14/1996	Metal
10994	9/2/1994	SVOC	10994	3/14/1996	Radionuclide
10994	9/2/1994	VOC	10994	6/7/1996	Metal
10994	11/30/1994	Metal	10994	6/7/1996	Radionuclide
10994	11/30/1994	PCB	10994	9/5/1996	Metal
10994	11/30/1994	Pesticide	10994	11/20/1996	Metal
10994	11/30/1994	SVOC	10994	11/20/1996	Radionuclide
10994	11/30/1994	VOC	10994	6/25/1997	Metal
10994	2/8/1995	Metal	10994	12/16/1997	Metal
10994	2/8/1995	Radionuclide	10994	7/14/1998	Radionuclide
10994	2/8/1995	VOC	10994	1/28/1999	Radionuclide
10994	2/8/1995	WQP	10994	7/19/1999	Metal
10994	5/24/1995	Metal	10994	7/19/1999	Radionuclide
10994	5/24/1995	PCB	10994	1/24/2000	Metal
10994	5/24/1995	Pesticide	10994	1/24/2000	Radionuclide
10994	5/24/1995	Radionuclide	10994	8/14/2000	Metal
10994	5/24/1995	SVOC	10994	8/14/2000	Radionuclide
10994	5/24/1995	VOC	10994	1/11/2001	Metal
10994	5/24/1995	WQP	10994	1/11/2001	Radionuclide
10994	11/1/1995	Radionuclide	10994	8/14/2001	Metal
10994	11/1/1995	WQP	10994	8/14/2001	Radionuclide
10994	3/14/1996	Radionuclide	10994	2/8/2002	Metal
10994	3/14/1996	VOC	10994	2/8/2002	Radionuclide
10994	3/14/1996	WQP	10994	7/15/2002	Metal
10994	6/7/1996	Radionuclide	10994	7/18/2002	Radionuclide
10994	6/7/1996	VOC	10994	1/14/2003	Metal
10994	6/7/1996	WQP	10994	1/14/2003	Radionuclide
10994	9/5/1996	Radionuclide	10994	2/25/2003	Metal
10994	11/20/1996	Radionuclide	10994	9/23/2003	Metal
10994	11/20/1996	VOC	10994	9/23/2003	Radionuclide
10994	11/20/1996	WQP	11094	12/20/1994	Metal
10994	6/25/1997	Radionuclide	11094	12/20/1994	Radionuclide
10994	6/25/1997	VOC	11094	2/10/1995	Metal
10994	6/25/1997	WQP	11094	2/10/1995	Radionuclide
10994	12/16/1997	Radionuclide	11094	5/22/1995	Metal
10994	12/16/1997	VOC	11094	5/22/1995	Radionuclide
10994	12/16/1997	WQP	20697	7/29/2004	Metal
10994	7/14/1998	Metal	20697	8/11/2004	Radionuclide
10994	7/14/1998	VOC	20797	8/11/2004	Metal

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10994	7/14/1998	WQP	20797	8/31/2004	Radionuclide
10994	9/24/1998	VOC	43392	9/22/1993	Radionuclide
10994	1/28/1999	Metal	43392	11/30/1993	Metal
10994	1/28/1999	VOC	43392	11/30/1993	Radionuclide
10994	1/28/1999	WQP	43392	3/4/1994	Radionuclide
10994	7/19/1999	VOC	43392	5/18/1994	Metal
10994	7/19/1999	WQP	43392	5/18/1994	Radionuclide
10994	1/24/2000	VOC	43392	8/18/1994	Metal
10994	1/24/2000	WQP	43392	8/18/1994	Radionuclide
10994	8/14/2000	VOC	43392	3/1/1995	Metal
10994	8/14/2000	WQP	43392	3/1/1995	Radionuclide
10994	1/11/2001	VOC	43392	5/18/1995	Metal
10994	1/11/2001	WQP	43392	5/18/1995	Radionuclide
10994	8/14/2001	VOC	43392	10/18/1995	Radionuclide
10994	1/31/2002	VOC	43392	1/17/1996	Radionuclide
10994	2/8/2002	WQP	43392	5/22/1996	Radionuclide
10994	7/15/2002	VOC	43392	8/29/1996	Metal
10994	7/23/2002	WQP	43392	11/12/1996	Metal
10994	1/14/2003	VOC	43392	11/12/1996	Radionuclide
10994	1/14/2003	WQP	43392	6/3/1997	Metal
10994	9/23/2003	VOC	43392	11/20/1997	Metal
10994	9/23/2003	WQP	43392	7/22/1998	Metal
11094	12/20/1994	Metal	43392	2/2/1999	Metal
11094	12/20/1994	PCB	43392	2/2/1999	Radionuclide
11094	12/20/1994	Pesticide	43392	7/20/1999	Metal
11094	12/20/1994	Radionuclide	43392	7/20/1999	Radionuclide
11094	12/20/1994	SVOC	43392	1/25/2000	Metal
11094	12/20/1994	VOC	43392	1/25/2000	Radionuclide
11094	12/20/1994	WQP	43392	9/7/2000	Metal
11094	2/10/1995	Metal	43392	9/7/2000	Radionuclide
11094	2/10/1995	PCB	43392	3/13/2001	Metal
11094	2/10/1995	Pesticide	43392	3/13/2001	Radionuclide
11094	2/10/1995	Radionuclide	43392	7/18/2001	Metal
11094	2/10/1995	SVOC	43392	7/18/2001	Radionuclide
11094	2/10/1995	VOC	43392	2/28/2002	Metal
11094	2/10/1995	WQP	43392	3/6/2002	Radionuclide
11094	5/22/1995	Metal	43392	8/21/2002	Radionuclide
11094	5/22/1995	Radionuclide	43392	9/6/2002	Metal
11094	5/22/1995	VOC	43392	9/11/2003	Metal
11094	5/22/1995	WQP	43392	9/11/2003	Radionuclide
11094	5/27/2003	VOC	56594	12/22/1994	Metal
20197	5/22/2001	VOC	56594	12/22/1994	Radionuclide
20397	5/17/2001	VOC	56594	4/25/1995	Metal
20597	5/22/2001	VOC	56594	4/25/1995	Radionuclide
20697	9/26/1997	VOC	56594	4/28/2003	Metal
20697	5/18/2001	VOC	56994	2/3/1995	Metal
20697	7/15/2004	VOC	56994	2/3/1995	Radionuclide
20797	7/30/1997	VOC	56994	5/16/1995	Metal
20797	5/17/2001	VOC	56994	5/16/1995	Radionuclide
20797	7/15/2004	VOC	56994	8/9/2004	Metal
21097	5/18/2001	VOC	56994	8/9/2004	Radionuclide
21097	7/15/2004	VOC	57094	8/11/2004	Metal

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43392	12/14/1992	Radionuclide	57094	8/11/2004	Radionuclide
43392	12/14/1992	VOC	57594	4/12/1995	Metal
43392	12/14/1992	WQP	57594	4/12/1995	Radionuclide
43392	9/22/1993	Radionuclide	5786	4/8/1987	Metal
43392	9/22/1993	VOC	5786	2/22/1990	Metal
43392	9/22/1993	WQP	5786	2/22/1990	Radionuclide
43392	11/30/1993	Radionuclide	5786	5/11/1990	Metal
43392	11/30/1993	VOC	5786	7/26/1990	Metal
43392	11/30/1993	WQP	5786	7/26/1990	Radionuclide
43392	3/4/1994	VOC	5786	10/12/1990	Radionuclide
43392	3/4/1994	WQP	5786	3/29/1991	Metal
43392	5/18/1994	Radionuclide	5786	3/29/1991	Radionuclide
43392	5/18/1994	VOC	5786	5/22/1991	Metal
43392	5/18/1994	WQP	5786	5/22/1991	Radionuclide
43392	8/18/1994	Radionuclide	5786	9/16/1991	Radionuclide
43392	8/18/1994	VOC	5786	2/18/1992	Metal
43392	8/18/1994	WQP	5786	2/18/1992	Radionuclide
43392	12/6/1994	Radionuclide	5786	4/29/1992	Metal
43392	12/6/1994	VOC	5786	4/29/1992	Radionuclide
43392	12/6/1994	WQP	5786	3/17/1993	Metal
43392	3/1/1995	Radionuclide	5786	3/17/1993	Radionuclide
43392	3/1/1995	VOC	5786	6/22/1993	Metal
43392	3/1/1995	WQP	5786	6/22/1993	Radionuclide
43392	5/18/1995	Radionuclide	5786	5/19/1994	Metal
43392	5/18/1995	VOC	5786	5/19/1994	Radionuclide
43392	5/18/1995	WQP	5786	2/28/1995	Metal
43392	10/18/1995	Radionuclide	5786	2/28/1995	Radionuclide
43392	10/18/1995	VOC	5786	5/22/1995	Metal
43392	1/17/1996	Radionuclide	5786	5/22/1995	Radionuclide
43392	1/17/1996	VOC	57894	1/22/1995	Metal
43392	5/22/1996	Radionuclide	57894	1/22/1995	Radionuclide
43392	5/22/1996	WQP	57894	4/25/1995	Metal
43392	8/29/1996	Radionuclide	57894	4/25/1995	Radionuclide
43392	8/29/1996	VOC	57994	5/11/1995	Metal
43392	8/29/1996	WQP	58094	12/21/1994	Metal
43392	11/12/1996	Radionuclide	58094	12/21/1994	Radionuclide
43392	11/12/1996	VOC	58094	4/26/1995	Metal
43392	11/12/1996	WQP	58094	4/26/1995	Radionuclide
43392	6/3/1997	VOC	58194	5/2/1995	Metal
43392	11/20/1997	VOC	58194	5/2/1995	Radionuclide
43392	7/22/1998	VOC	58494	5/3/1995	Metal
43392	2/2/1999	Radionuclide	58494	5/3/1995	Radionuclide
43392	2/2/1999	VOC	58494	8/12/2004	Metal
43392	7/20/1999	Radionuclide	58594	12/21/1994	Metal
43392	7/20/1999	VOC	58594	12/21/1994	Radionuclide
43392	1/25/2000	Radionuclide	58594	4/25/1995	Metal
43392	1/25/2000	VOC	58594	4/25/1995	Radionuclide
43392	9/7/2000	Radionuclide	59194	6/27/1995	Metal
43392	9/7/2000	VOC	59194	6/27/1995	Radionuclide
43392	3/1/2001	VOC	59194	8/9/2004	Metal
43392	3/27/2001	Radionuclide	59194	8/9/2004	Radionuclide
43392	7/18/2001	Radionuclide	59294	8/3/2004	Metal

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43392	7/18/2001	VOC	59294	8/3/2004	Radionuclide
43392	2/28/2002	VOC	59393	3/29/1994	Metal
43392	3/28/2002	Radionuclide	59393	3/29/1994	Radionuclide
43392	7/9/2002	VOC	59393	5/20/1994	Metal
43392	8/21/2002	Radionuclide	59393	5/20/1994	Radionuclide
43392	3/27/2003	VOC	59393	1/7/1995	Radionuclide
43392	8/27/2003	VOC	59393	3/8/1995	Metal
43392	9/29/2003	Radionuclide	59393	3/8/1995	Radionuclide
56594	12/22/1994	PCB	59393	4/26/1995	Metal
56594	12/22/1994	Pesticide	59393	4/26/1995	Radionuclide
56594	12/22/1994	Radionuclide	59393	11/16/1995	Metal
56594	12/22/1994	SVOC	59393	11/16/1995	Radionuclide
56594	12/22/1994	VOC	59393	4/30/1996	Metal
56594	12/22/1994	WQP	59393	4/30/1996	Radionuclide
56594	4/25/1995	Metal	59393	11/8/1996	Radionuclide
56594	4/25/1995	Radionuclide	59493	6/25/1993	Metal
56594	4/25/1995	SVOC	59493	6/25/1993	Radionuclide
56594	4/25/1995	VOC	59493	8/11/1993	Metal
56594	4/25/1995	WQP	59493	8/11/1993	Radionuclide
56594	4/28/2003	Radionuclide	59493	11/9/1993	Metal
56594	4/28/2003	VOC	59493	11/9/1993	Radionuclide
56994	2/3/1995	PCB	59493	3/14/1994	Metal
56994	2/3/1995	Pesticide	59493	3/14/1994	Radionuclide
56994	2/3/1995	Radionuclide	59493	5/9/1994	Metal
56994	2/3/1995	SVOC	59493	5/9/1994	Radionuclide
56994	2/3/1995	VOC	59493	8/19/1994	Metal
56994	2/3/1995	WQP	59493	8/19/1994	Radionuclide
56994	5/16/1995	Radionuclide	59493	10/21/1994	Metal
56994	5/16/1995	SVOC	59493	10/21/1994	Radionuclide
56994	5/16/1995	VOC	59493	1/4/1995	Metal
56994	5/16/1995	WQP	59493	1/4/1995	Radionuclide
56994	6/6/2001	VOC	59493	3/9/1995	Metal
56994	8/9/2004	VOC	59493	3/9/1995	Radionuclide
57094	6/1/1995	SVOC	59493	6/9/1995	Metal
57094	6/1/1995	VOC	59493	6/9/1995	Radionuclide
57094	6/11/2001	VOC	59593	6/25/1993	Metal
57094	5/8/2003	VOC	59593	6/25/1993	Radionuclide
57094	8/11/2004	VOC	59593	8/13/1993	Metal
57594	4/12/1995	PCB	59593	8/13/1993	Radionuclide
57594	4/12/1995	Pesticide	59593	11/10/1993	Metal
57594	4/12/1995	Radionuclide	59593	11/10/1993	Radionuclide
57594	4/12/1995	SVOC	59593	3/14/1994	Metal
57594	4/12/1995	VOC	59593	3/14/1994	Radionuclide
57594	4/12/1995	WQP	59593	5/9/1994	Metal
5786	4/8/1987	Radionuclide	59593	5/9/1994	Radionuclide
5786	4/8/1987	VOC	59593	8/19/1994	Metal
5786	4/8/1987	WQP	59593	8/19/1994	Radionuclide
5786	12/15/1989	VOC	59593	10/24/1994	Metal
5786	2/22/1990	Radionuclide	59593	10/24/1994	Radionuclide
5786	2/22/1990	VOC	59593	1/11/1995	Metal
5786	2/22/1990	WQP	59593	1/11/1995	Radionuclide
5786	5/11/1990	VOC	59593	3/9/1995	Metal

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5786	5/11/1990	WQP	59593	3/9/1995	Radionuclide
5786	7/26/1990	Radionuclide	59593	6/14/1995	Metal
5786	7/26/1990	VOC	59593	6/14/1995	Radionuclide
5786	7/26/1990	WQP	59594	1/25/1995	Metal
5786	10/12/1990	VOC	59594	1/25/1995	Radionuclide
5786	3/29/1991	Radionuclide	59594	5/15/1995	Metal
5786	3/29/1991	VOC	59594	5/15/1995	Radionuclide
5786	3/29/1991	WQP	59594	7/28/2004	Metal
5786	5/22/1991	Radionuclide	59594	7/28/2004	Radionuclide
5786	5/22/1991	VOC	59694	3/8/1995	Metal
5786	5/22/1991	WQP	59694	3/8/1995	Radionuclide
5786	9/16/1991	Radionuclide	59694	5/23/1995	Metal
5786	9/16/1991	VOC	59694	5/23/1995	Radionuclide
5786	9/16/1991	WQP	59793	1/15/1995	Radionuclide
5786	12/14/1991	Radionuclide	59793	5/12/1995	Metal
5786	12/14/1991	VOC	59793	5/12/1995	Radionuclide
5786	12/14/1991	WQP	59894	3/8/1995	Metal
5786	2/18/1992	Metal	59894	3/8/1995	Radionuclide
5786	2/18/1992	Radionuclide	59894	5/16/1995	Metal
5786	2/18/1992	VOC	59894	5/16/1995	Radionuclide
5786	2/18/1992	WQP	59993	1/23/1995	Radionuclide
5786	4/29/1992	Metal	59993	5/11/1995	Metal
5786	4/29/1992	Radionuclide	60093	5/9/1995	Metal
5786	4/29/1992	VOC	60093	5/9/1995	Radionuclide
5786	4/29/1992	WQP	60293	1/22/1995	Metal
5786	3/17/1993	Radionuclide	60293	1/22/1995	Radionuclide
5786	3/17/1993	VOC	60293	4/20/1995	Metal
5786	3/17/1993	WQP	60293	4/20/1995	Radionuclide
5786	6/22/1993	Radionuclide	60393	5/10/1995	Metal
5786	6/22/1993	VOC	60393	5/10/1995	Radionuclide
5786	6/22/1993	WQP	60593	5/4/1995	Metal
5786	2/25/1994	Radionuclide	60593	5/4/1995	Radionuclide
5786	2/25/1994	VOC	60693	5/4/1995	Metal
5786	2/25/1994	WQP	60693	5/4/1995	Radionuclide
5786	5/19/1994	Radionuclide	60893	7/7/1993	Radionuclide
5786	5/19/1994	VOC	60893	1/26/1995	Metal
5786	5/19/1994	WQP	60893	1/26/1995	Radionuclide
5786	2/28/1995	Radionuclide	60893	4/20/1995	Metal
5786	2/28/1995	VOC	60893	4/20/1995	Radionuclide
5786	2/28/1995	WQP	60993	5/10/1995	Metal
5786	5/22/1995	Radionuclide	61093	7/13/1993	Radionuclide
5786	5/22/1995	VOC	61093	1/25/1995	Metal
5786	5/22/1995	WQP	61093	1/25/1995	Radionuclide
57894	1/22/1995	Metal	61093	4/24/1995	Metal
57894	1/22/1995	PCB	61093	4/24/1995	Radionuclide
57894	1/22/1995	Pesticide	61293	1/7/1995	Metal
57894	1/22/1995	Radionuclide	61293	1/7/1995	Radionuclide
57894	1/22/1995	SVOC	61293	8/2/2004	Metal
57894	1/22/1995	VOC	62793	7/13/1993	Radionuclide
57894	1/22/1995	WQP	62793	1/23/1995	Radionuclide
57894	4/25/1995	Metal	62793	5/11/1995	Metal
57894	4/25/1995	Radionuclide	62893	7/13/1993	Radionuclide

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57894	4/25/1995	SVOC	62893	1/18/1995	Metal
57894	4/25/1995	VOC	62893	1/18/1995	Radionuclide
57894	4/25/1995	WQP	62893	4/18/1995	Metal
57994	5/11/1995	VOC	62893	4/18/1995	Radionuclide
57994	5/29/2001	VOC	63193	7/12/1993	Radionuclide
57994	8/10/2004	VOC	63193	1/10/1995	Metal
58094	12/21/1994	PCB	63193	1/10/1995	Radionuclide
58094	12/21/1994	Pesticide	63193	4/17/1995	Metal
58094	12/21/1994	Radionuclide	63193	4/17/1995	Radionuclide
58094	12/21/1994	SVOC	63893	1/5/1995	Metal
58094	12/21/1994	VOC	63893	1/5/1995	Radionuclide
58094	12/21/1994	WQP	63893	4/18/1995	Metal
58094	4/26/1995	Metal	63893	4/18/1995	Radionuclide
58094	4/26/1995	Radionuclide	63993	1/5/1995	Metal
58094	4/26/1995	SVOC	63993	1/5/1995	Radionuclide
58094	4/26/1995	VOC	63993	4/18/1995	Metal
58094	4/26/1995	WQP	63993	4/18/1995	Radionuclide
58094	5/24/2001	VOC	64093	1/5/1995	Metal
58194	5/2/1995	Metal	64093	1/5/1995	Radionuclide
58194	5/2/1995	Radionuclide	64093	4/18/1995	Metal
58194	5/2/1995	SVOC	64093	4/18/1995	Radionuclide
58194	5/2/1995	VOC	7086	10/2/1986	Metal
58194	5/2/1995	WQP	7086	5/18/1987	Metal
58194	5/23/2001	VOC	7086	5/27/1987	Metal
58494	5/3/1995	Metal	7086	7/6/1987	Metal
58494	5/3/1995	Radionuclide	7086	7/6/1987	Radionuclide
58494	5/3/1995	SVOC	7086	12/8/1987	Metal
58494	5/3/1995	VOC	7086	12/8/1987	Radionuclide
58494	5/3/1995	WQP	7086	2/15/1988	Metal
58494	8/21/1997	VOC	7086	2/15/1988	Radionuclide
58494	6/6/2001	VOC	7086	4/7/1988	Metal
58494	7/10/2003	VOC	7086	4/7/1988	Radionuclide
58594	12/21/1994	PCB	7086	7/13/1988	Metal
58594	12/21/1994	Pesticide	7086	7/13/1988	Radionuclide
58594	12/21/1994	Radionuclide	7086	10/18/1988	Metal
58594	12/21/1994	SVOC	7086	1/16/1989	Metal
58594	12/21/1994	VOC	7086	1/16/1989	Radionuclide
58594	12/21/1994	WQP	7086	4/12/1989	Metal
58594	4/25/1995	Metal	7086	7/25/1989	Metal
58594	4/25/1995	Radionuclide	7086	7/25/1989	Radionuclide
58594	4/25/1995	SVOC	7086	11/30/1989	Metal
58594	4/25/1995	VOC	7086	2/22/1990	Metal
58594	4/25/1995	WQP	7086	5/24/1990	Metal
58594	8/21/1997	VOC	7086	7/20/1990	Metal
58594	5/21/2001	VOC	7086	7/20/1990	Radionuclide
58693	5/18/1993	Metal	7086	10/19/1990	Metal
58693	5/18/1993	Radionuclide	7086	10/19/1990	Radionuclide
58693	5/18/1993	VOC	7086	5/14/1991	Metal
59194	6/27/1995	Radionuclide	7086	5/14/1991	Radionuclide
59194	6/27/1995	SVOC	7086	9/6/1991	Metal
59194	6/27/1995	VOC	7086	9/6/1991	Radionuclide
59194	6/27/1995	WQP	7086	12/6/1991	Metal

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59194	7/31/2003	VOC	7086	12/6/1991	Radionuclide
59194	8/9/2004	VOC	7086	2/17/1992	Metal
59294	5/28/2003	VOC	7086	2/17/1992	Radionuclide
59294	8/3/2004	VOC	7086	4/28/1992	Metal
59393	3/29/1994	Metal	7086	4/28/1992	Radionuclide
59393	3/29/1994	Radionuclide	7086	8/14/1992	Metal
59393	3/29/1994	SVOC	7086	8/14/1992	Radionuclide
59393	3/29/1994	VOC	7086	11/6/1992	Metal
59393	3/29/1994	WQP	7086	11/6/1992	Radionuclide
59393	5/20/1994	Metal	7086	3/8/1993	Metal
59393	5/20/1994	Radionuclide	7086	3/8/1993	Radionuclide
59393	5/20/1994	VOC	7086	6/3/1993	Metal
59393	6/8/1994	Radionuclide	7086	6/3/1993	Radionuclide
59393	6/8/1994	SVOC	7086	9/20/1993	Metal
59393	6/8/1994	VOC	7086	9/20/1993	Radionuclide
59393	6/8/1994	WQP	7086	12/10/1993	Metal
59393	8/19/1994	SVOC	7086	12/10/1993	Radionuclide
59393	8/19/1994	VOC	7086	2/23/1994	Metal
59393	8/19/1994	WQP	7086	2/23/1994	Radionuclide
59393	10/26/1994	VOC	7086	5/16/1994	Metal
59393	10/26/1994	WQP	7086	5/16/1994	Radionuclide
59393	1/7/1995	Metal	7086	8/25/1994	Metal
59393	1/7/1995	Radionuclide	7086	8/25/1994	Radionuclide
59393	1/7/1995	VOC	7086	11/21/1994	Metal
59393	3/8/1995	Metal	7086	11/21/1994	Radionuclide
59393	3/8/1995	SVOC	7086	3/10/1995	Metal
59393	3/8/1995	VOC	7086	3/10/1995	Radionuclide
59393	3/8/1995	WQP	7086	11/9/1995	Metal
59393	4/26/1995	Metal	7086	11/9/1995	Radionuclide
59393	4/26/1995	Radionuclide	7086	4/26/1996	Metal
59393	4/26/1995	SVOC	7086	4/26/1996	Radionuclide
59393	4/26/1995	VOC	7086	7/18/1996	Metal
59393	4/26/1995	WQP	7086	7/18/1996	Radionuclide
59393	11/16/1995	Radionuclide	7086	11/25/1996	Metal
59393	11/16/1995	VOC	7086	11/25/1996	Radionuclide
59393	11/16/1995	WQP	7086	7/31/1997	Metal
59393	4/30/1996	Radionuclide	7086	2/27/1998	Metal
59393	4/30/1996	VOC	7086	7/28/1998	Metal
59393	4/30/1996	WQP	7086	7/28/1998	Radionuclide
59393	11/8/1996	Radionuclide	7086	2/8/1999	Radionuclide
59393	11/8/1996	VOC	7086	8/18/1999	Radionuclide
59393	11/8/1996	WQP	7086	2/7/2000	Metal
59393	5/29/2003	VOC	7086	2/7/2000	Radionuclide
59394	8/21/1997	VOC	7086	7/31/2000	Radionuclide
59493	6/25/1993	Metal	7086	2/23/2001	Metal
59493	6/25/1993	Radionuclide	7086	2/23/2001	Radionuclide
59493	6/25/1993	SVOC	7086	9/10/2001	Metal
59493	6/25/1993	VOC	7086	9/10/2001	Radionuclide
59493	6/25/1993	WQP	71494	3/14/1995	Metal
59493	8/11/1993	Metal	71494	3/14/1995	Radionuclide
59493	8/11/1993	Radionuclide	71494	5/16/1995	Metal
59493	8/11/1993	SVOC	71494	5/16/1995	Radionuclide

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59493	8/11/1993	VOC	P416689	2/16/1994	Metal
59493	8/11/1993	WQP	P416689	4/29/1994	Metal
59493	11/9/1993	Metal	P416689	8/19/1994	Metal
59493	11/9/1993	Radionuclide	P416689	4/25/1995	Metal
59493	11/9/1993	SVOC	P416689	10/17/1995	Radionuclide
59493	11/9/1993	VOC	P416689	2/19/1996	Radionuclide
59493	11/9/1993	WQP	P416689	4/30/1996	Radionuclide
59493	3/14/1994	Metal	P416689	7/17/1996	Radionuclide
59493	3/14/1994	Radionuclide	P416689	1/28/1997	Metal
59493	3/14/1994	SVOC	P416689	6/3/1997	Metal
59493	3/14/1994	VOC	P416689	12/3/1997	Metal
59493	3/14/1994	WQP	P416689	4/29/1998	Metal
59493	5/9/1994	Metal	P416689	10/19/1998	Metal
59493	5/9/1994	Radionuclide	P416689	4/26/1999	Metal
59493	5/9/1994	SVOC	P416689	10/19/1999	Metal
59493	5/9/1994	VOC	P416689	5/8/2000	Metal
59493	5/9/1994	WQP	P416689	5/8/2000	Radionuclide
59493	8/19/1994	Metal	P416689	12/12/2000	Metal
59493	8/19/1994	Radionuclide	P416689	12/12/2000	Radionuclide
59493	8/19/1994	SVOC	P416689	4/9/2001	Metal
59493	8/19/1994	VOC	P416689	4/9/2001	Radionuclide
59493	8/19/1994	WQP	P416689	12/12/2001	Metal
59493	10/21/1994	Metal	P416689	12/12/2001	Radionuclide
59493	10/21/1994	Radionuclide	P416689	5/8/2002	Radionuclide
59493	10/21/1994	SVOC	P416689	5/16/2002	Metal
59493	10/21/1994	VOC	P416689	10/22/2002	Metal
59493	10/21/1994	WQP	P416689	10/31/2002	Radionuclide
59493	1/4/1995	PCB	P416689	5/6/2003	Metal
59493	1/4/1995	Pesticide	P416689	5/6/2003	Radionuclide
59493	1/4/1995	Radionuclide	P416689	6/10/2003	Metal
59493	1/4/1995	SVOC	P416689	7/9/2003	Metal
59493	1/4/1995	VOC	P416689	3/16/2004	Metal
59493	1/4/1995	WQP	P416689	4/19/2004	Metal
59493	3/9/1995	Metal	P416689	5/25/2004	Metal
59493	3/9/1995	Radionuclide			
59493	3/9/1995	SVOC			
59493	3/9/1995	VOC			
59493	3/9/1995	WQP			
59493	6/9/1995	Metal			
59493	6/9/1995	Radionuclide			
59493	6/9/1995	SVOC			
59493	6/9/1995	VOC			
59493	6/9/1995	WQP			
59493	7/31/2003	VOC			
59593	6/25/1993	Metal			
59593	6/25/1993	Radionuclide			
59593	6/25/1993	SVOC			
59593	6/25/1993	VOC			
59593	6/25/1993	WQP			
59593	8/13/1993	Metal			
59593	8/13/1993	Radionuclide			
59593	8/13/1993	SVOC			

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59593	8/13/1993	VOC
59593	8/13/1993	WQP
59593	11/10/1993	Metal
59593	11/10/1993	Radionuclide
59593	11/10/1993	SVOC
59593	11/10/1993	VOC
59593	11/10/1993	WQP
59593	3/14/1994	Metal
59593	3/14/1994	Radionuclide
59593	3/14/1994	SVOC
59593	3/14/1994	VOC
59593	3/14/1994	WQP
59593	5/9/1994	Metal
59593	5/9/1994	Radionuclide
59593	5/9/1994	SVOC
59593	5/9/1994	VOC
59593	5/9/1994	WQP
59593	8/19/1994	Metal
59593	8/19/1994	Radionuclide
59593	8/19/1994	SVOC
59593	8/19/1994	VOC
59593	8/19/1994	WQP
59593	10/24/1994	Metal
59593	10/24/1994	Radionuclide
59593	10/24/1994	SVOC
59593	10/24/1994	VOC
59593	10/24/1994	WQP
59593	1/11/1995	Radionuclide
59593	1/11/1995	WQP
59593	3/9/1995	Metal
59593	3/9/1995	Radionuclide
59593	3/9/1995	SVOC
59593	3/9/1995	VOC
59593	3/9/1995	WQP
59593	6/14/1995	Metal
59593	6/14/1995	Radionuclide
59593	6/14/1995	SVOC
59593	6/14/1995	VOC
59593	6/14/1995	WQP
59593	5/29/2003	VOC
59594	1/25/1995	PCB
59594	1/25/1995	Pesticide
59594	1/25/1995	Radionuclide
59594	1/25/1995	SVOC
59594	1/25/1995	VOC
59594	1/25/1995	WQP
59594	5/15/1995	Radionuclide
59594	5/15/1995	SVOC
59594	5/15/1995	VOC
59594	5/15/1995	WQP
59594	7/31/2003	VOC
59694	3/8/1995	PCB

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59694	3/8/1995	Pesticide
59694	3/8/1995	Radionuclide
59694	3/8/1995	SVOC
59694	3/8/1995	VOC
59694	5/23/1995	PCB
59694	5/23/1995	Pesticide
59694	5/23/1995	Radionuclide
59694	5/23/1995	SVOC
59694	5/23/1995	VOC
59694	5/23/1995	WQP
59694	7/31/2003	VOC
59793	1/15/1995	Radionuclide
59793	1/15/1995	VOC
59793	5/12/1995	Metal
59793	5/12/1995	Radionuclide
59793	5/12/1995	SVOC
59793	5/12/1995	VOC
59793	5/12/1995	WQP
59793	5/17/2001	VOC
59794	7/10/2003	VOC
59894	3/8/1995	PCB
59894	3/8/1995	Pesticide
59894	3/8/1995	Radionuclide
59894	3/8/1995	SVOC
59894	3/8/1995	VOC
59894	3/8/1995	WQP
59894	5/16/1995	Radionuclide
59894	5/16/1995	SVOC
59894	5/16/1995	VOC
59894	5/16/1995	WQP
59993	7/6/1993	Radionuclide
59993	7/6/1993	VOC
59993	1/23/1995	Radionuclide
59993	1/23/1995	VOC
59993	6/7/2001	VOC
60093	7/6/1993	VOC
60093	5/9/1995	Metal
60093	5/9/1995	Radionuclide
60093	5/9/1995	SVOC
60093	5/9/1995	VOC
60093	5/9/1995	WQP
60293	7/6/1993	Metal
60293	7/6/1993	PCB
60293	7/6/1993	Pesticide
60293	7/6/1993	Radionuclide
60293	7/6/1993	SVOC
60293	7/6/1993	VOC
60293	7/6/1993	WQP
60293	1/22/1995	Metal
60293	1/22/1995	PCB
60293	1/22/1995	Pesticide
60293	1/22/1995	Radionuclide

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60293	1/22/1995	SVOC
60293	1/22/1995	VOC
60293	1/22/1995	WQP
60293	4/20/1995	Metal
60293	4/20/1995	Radionuclide
60293	4/20/1995	SVOC
60293	4/20/1995	VOC
60293	4/20/1995	WQP
60393	5/10/1995	Radionuclide
60393	5/10/1995	VOC
60493	7/13/1993	VOC
60493	7/29/2003	VOC
60593	7/7/1993	VOC
60593	5/4/1995	Metal
60593	5/4/1995	Radionuclide
60593	5/4/1995	SVOC
60593	5/4/1995	VOC
60593	5/4/1995	WQP
60693	7/7/1993	VOC
60693	5/4/1995	Metal
60693	5/4/1995	Radionuclide
60693	5/4/1995	SVOC
60693	5/4/1995	VOC
60693	5/4/1995	WQP
60893	7/7/1993	VOC
60893	1/26/1995	Metal
60893	1/26/1995	Radionuclide
60893	1/26/1995	SVOC
60893	1/26/1995	VOC
60893	4/20/1995	Metal
60893	4/20/1995	Radionuclide
60893	4/20/1995	SVOC
60893	4/20/1995	VOC
60893	4/20/1995	WQP
60993	5/10/1995	VOC
61093	7/13/1993	Metal
61093	7/13/1993	PCB
61093	7/13/1993	Pesticide
61093	7/13/1993	Radionuclide
61093	7/13/1993	SVOC
61093	7/13/1993	VOC
61093	7/13/1993	WQP
61093	1/25/1995	Metal
61093	1/25/1995	PCB
61093	1/25/1995	Pesticide
61093	1/25/1995	Radionuclide
61093	1/25/1995	SVOC
61093	1/25/1995	VOC
61093	1/25/1995	WQP
61093	4/24/1995	Metal
61093	4/24/1995	Radionuclide
61093	4/24/1995	SVOC

Table 2.
Sampling and Analytical Summary for OLF Groundwater

61093	4/24/1995	VOC
61093	4/24/1995	WQP
61093	6/23/2004	VOC
61293	1/7/1995	Radionuclide
61293	1/7/1995	VOC
61293	5/22/1995	SVOC
61293	5/22/1995	VOC
61293	5/22/1995	WQP
61293	5/2/2003	VOC
61293	8/2/2004	Radionuclide
61293	8/2/2004	VOC
62793	7/13/1993	VOC
62793	1/23/1995	Radionuclide
62793	1/23/1995	VOC
62793	5/11/1995	VOC
62793	5/29/2001	VOC
62893	7/13/1993	VOC
62893	1/18/1995	Metal
62893	1/18/1995	Radionuclide
62893	2/1/1995	VOC
62893	4/18/1995	Metal
62893	4/18/1995	Radionuclide
62893	4/18/1995	SVOC
62893	4/18/1995	VOC
62893	4/18/1995	WQP
62893	8/21/1997	VOC
62893	5/29/2001	Radionuclide
62893	5/29/2001	VOC
62893	5/27/2003	VOC
63193	7/12/1993	Metal
63193	7/12/1993	PCB
63193	7/12/1993	Pesticide
63193	7/12/1993	Radionuclide
63193	7/12/1993	SVOC
63193	7/12/1993	VOC
63193	7/12/1993	WQP
63193	1/10/1995	Radionuclide
63193	1/10/1995	SVOC
63193	1/10/1995	VOC
63193	1/10/1995	WQP
63193	4/17/1995	Metal
63193	4/17/1995	Radionuclide
63193	4/17/1995	SVOC
63193	4/17/1995	VOC
63193	4/17/1995	WQP
63193	8/21/1997	VOC
63193	5/21/2001	VOC
63193	5/28/2003	VOC
63893	1/5/1995	PCB
63893	1/5/1995	Pesticide
63893	1/5/1995	Radionuclide
63893	1/5/1995	SVOC

Table 2.
Sampling and Analytical Summary for OLF Groundwater

63893	1/5/1995	VOC
63893	1/5/1995	WQP
63893	4/18/1995	Metal
63893	4/18/1995	Radionuclide
63893	4/18/1995	SVOC
63893	4/18/1995	VOC
63893	4/18/1995	WQP
63993	1/5/1995	PCB
63993	1/5/1995	Pesticide
63993	1/5/1995	Radionuclide
63993	1/5/1995	SVOC
63993	1/5/1995	VOC
63993	1/5/1995	WQP
63993	4/18/1995	Metal
63993	4/18/1995	Radionuclide
63993	4/18/1995	SVOC
63993	4/18/1995	VOC
63993	4/18/1995	WQP
64093	1/5/1995	PCB
64093	1/5/1995	Pesticide
64093	1/5/1995	Radionuclide
64093	1/5/1995	SVOC
64093	1/5/1995	VOC
64093	1/5/1995	WQP
64093	4/18/1995	Metal
64093	4/18/1995	Radionuclide
64093	4/18/1995	SVOC
64093	4/18/1995	VOC
64093	4/18/1995	WQP
7086	10/2/1986	Metal
7086	10/2/1986	PCB
7086	10/2/1986	Pesticide
7086	10/2/1986	Radionuclide
7086	10/2/1986	VOC
7086	10/2/1986	WQP
7086	5/18/1987	Radionuclide
7086	5/18/1987	VOC
7086	5/18/1987	WQP
7086	5/27/1987	Radionuclide
7086	5/27/1987	VOC
7086	5/27/1987	WQP
7086	7/6/1987	VOC
7086	7/6/1987	WQP
7086	12/8/1987	VOC
7086	12/8/1987	WQP
7086	2/15/1988	VOC
7086	2/15/1988	WQP
7086	4/7/1988	VOC
7086	4/7/1988	WQP
7086	7/13/1988	WQP
7086	10/18/1988	VOC
7086	10/18/1988	WQP

Table 2.
Sampling and Analytical Summary for OLF Groundwater

7086	1/16/1989	VOC
7086	1/16/1989	WQP
7086	4/12/1989	VOC
7086	4/12/1989	WQP
7086	7/25/1989	VOC
7086	7/25/1989	WQP
7086	11/30/1989	Radionuclide
7086	11/30/1989	VOC
7086	11/30/1989	WQP
7086	2/22/1990	Radionuclide
7086	2/22/1990	VOC
7086	2/22/1990	WQP
7086	5/24/1990	Radionuclide
7086	5/24/1990	VOC
7086	5/24/1990	WQP
7086	7/20/1990	Radionuclide
7086	7/20/1990	VOC
7086	7/20/1990	WQP
7086	10/19/1990	Radionuclide
7086	10/19/1990	VOC
7086	10/19/1990	WQP
7086	5/14/1991	Radionuclide
7086	5/14/1991	VOC
7086	5/14/1991	WQP
7086	9/6/1991	Metal
7086	9/6/1991	Radionuclide
7086	9/6/1991	VOC
7086	9/6/1991	WQP
7086	12/6/1991	Metal
7086	12/6/1991	Radionuclide
7086	12/6/1991	VOC
7086	12/6/1991	WQP
7086	2/17/1992	Metal
7086	2/17/1992	Radionuclide
7086	2/17/1992	VOC
7086	2/17/1992	WQP
7086	4/28/1992	Metal
7086	4/28/1992	Radionuclide
7086	4/28/1992	VOC
7086	4/28/1992	WQP
7086	8/14/1992	Metal
7086	8/14/1992	Radionuclide
7086	8/14/1992	VOC
7086	8/14/1992	WQP
7086	11/6/1992	Metal
7086	11/6/1992	Radionuclide
7086	11/6/1992	VOC
7086	11/6/1992	WQP
7086	3/8/1993	Radionuclide
7086	3/8/1993	VOC
7086	3/8/1993	WQP
7086	6/3/1993	Radionuclide

Table 2.
Sampling and Analytical Summary for OLF Groundwater

7086	6/3/1993	VOC
7086	6/3/1993	WQP
7086	9/20/1993	Radionuclide
7086	9/20/1993	VOC
7086	9/20/1993	WQP
7086	12/10/1993	Radionuclide
7086	12/10/1993	VOC
7086	12/10/1993	WQP
7086	2/23/1994	Radionuclide
7086	2/23/1994	VOC
7086	2/23/1994	WQP
7086	5/16/1994	Radionuclide
7086	5/16/1994	VOC
7086	5/16/1994	WQP
7086	8/25/1994	Radionuclide
7086	8/25/1994	VOC
7086	8/25/1994	WQP
7086	11/21/1994	Radionuclide
7086	11/21/1994	VOC
7086	11/21/1994	WQP
7086	3/10/1995	Radionuclide
7086	3/10/1995	VOC
7086	3/10/1995	WQP
7086	11/9/1995	Radionuclide
7086	11/9/1995	VOC
7086	11/9/1995	WQP
7086	4/26/1996	Radionuclide
7086	4/26/1996	VOC
7086	4/26/1996	WQP
7086	7/18/1996	Radionuclide
7086	7/18/1996	VOC
7086	7/18/1996	WQP
7086	11/25/1996	Radionuclide
7086	11/25/1996	VOC
7086	7/31/1997	Radionuclide
7086	7/31/1997	VOC
7086	7/31/1997	WQP
7086	2/27/1998	Radionuclide
7086	2/27/1998	VOC
7086	2/27/1998	WQP
7086	7/28/1998	VOC
7086	7/28/1998	WQP
7086	2/8/1999	Metal
7086	2/8/1999	VOC
7086	2/8/1999	WQP
7086	8/18/1999	Metal
7086	8/19/1999	VOC
7086	8/19/1999	WQP
7086	2/7/2000	VOC
7086	2/7/2000	WQP
7086	7/31/2000	Metal
7086	7/31/2000	Radionuclide

Table 2.
Sampling and Analytical Summary for OLF Groundwater

7086	7/31/2000	VOC
7086	7/31/2000	WQP
7086	2/23/2001	VOC
7086	2/23/2001	WQP
7086	9/10/2001	VOC
7086	9/10/2001	WQP
7086	2/7/2002	Metal
7086	2/7/2002	Radionuclide
7086	2/7/2002	VOC
7086	2/7/2002	WQP
7086	3/11/2002	Metal
7086	4/15/2002	Metal
7086	5/16/2002	Metal
7086	9/4/2002	Metal
7086	9/4/2002	Radionuclide
7086	9/4/2002	VOC
7086	9/4/2002	WQP
7086	2/11/2003	Metal
7086	2/11/2003	Radionuclide
7086	2/11/2003	VOC
7086	2/11/2003	WQP
7086	8/26/2003	Metal
7086	8/26/2003	Radionuclide
7086	8/26/2003	VOC
7086	8/26/2003	WQP
7086	9/30/2003	Metal
7086	10/23/2003	Metal
7086	10/23/2003	Radionuclide
7086	10/23/2003	VOC
7086	5/12/2004	Metal
7086	5/12/2004	Radionuclide
7086	5/12/2004	VOC
71494	3/14/1995	PCB
71494	3/14/1995	Pesticide
71494	3/14/1995	Radionuclide
71494	3/14/1995	SVOC
71494	3/14/1995	VOC
71494	3/14/1995	WQP
71494	5/16/1995	PCB
71494	5/16/1995	Pesticide
71494	5/16/1995	Radionuclide
71494	5/16/1995	SVOC
71494	5/16/1995	VOC
71494	5/16/1995	WQP
71494	8/12/2003	VOC
P416689	11/22/1993	Radionuclide
P416689	11/22/1993	SVOC
P416689	11/22/1993	VOC
P416689	11/22/1993	WQP
P416689	2/16/1994	VOC
P416689	4/29/1994	Metal
P416689	4/29/1994	Radionuclide

Table 2.
Sampling and Analytical Summary for OLF Groundwater

P416689	4/29/1994	VOC
P416689	8/19/1994	Radionuclide
P416689	8/19/1994	VOC
P416689	11/8/1994	Radionuclide
P416689	11/8/1994	VOC
P416689	11/8/1994	WQP
P416689	1/31/1995	Radionuclide
P416689	1/31/1995	VOC
P416689	1/31/1995	WQP
P416689	4/25/1995	Metal
P416689	4/25/1995	Radionuclide
P416689	4/25/1995	VOC
P416689	8/16/1995	Radionuclide
P416689	8/16/1995	VOC
P416689	8/16/1995	WQP
P416689	10/17/1995	Radionuclide
P416689	10/17/1995	VOC
P416689	2/19/1996	Radionuclide
P416689	2/19/1996	VOC
P416689	4/30/1996	Radionuclide
P416689	4/30/1996	VOC
P416689	7/17/1996	Radionuclide
P416689	7/17/1996	VOC
P416689	7/17/1996	WQP
P416689	1/28/1997	VOC
P416689	6/3/1997	VOC
P416689	12/3/1997	VOC
P416689	3/12/1998	VOC
P416689	4/29/1998	VOC
P416689	10/19/1998	VOC
P416689	4/26/1999	Radionuclide
P416689	4/26/1999	VOC
P416689	10/19/1999	Radionuclide
P416689	10/19/1999	VOC
P416689	5/8/2000	Radionuclide
P416689	5/8/2000	VOC
P416689	12/6/2000	VOC
P416689	12/29/2000	Radionuclide
P416689	4/9/2001	VOC
P416689	4/30/2001	Radionuclide
P416689	12/4/2001	VOC
P416689	4/29/2002	VOC
P416689	6/12/2002	Radionuclide
P416689	10/14/2002	VOC
P416689	11/21/2002	Radionuclide
P416689	4/28/2003	VOC
P416689	5/6/2003	Radionuclide
P416689	10/22/2003	VOC
P416689	4/13/2004	VOC
P416689	6/22/2004	VOC
P416689	7/20/2004	VOC
P416689	8/17/2004	VOC

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Table 3.
Sampling and Analytical Summary for OLF Surface Water

Upgradient Woman Creek						Downgradient Woman Creek						South Interceptor Ditch					
Total Concentrations			Dissolved Concentrations			Total Concentrations			Dissolved Concentrations			Total Concentrations			Dissolved Concentrations		
Location Code	Collection Date	Analyte Group	Location Code	Collection Date	Analyte Group	Location C	Collection Date	Analyte Group	Location Code	Collection Date	Analyte Group	Location Code	Collection Date	Analyte Group	Location Code	Collection Date	Analyte Group
SW039	06/27/88	Metal	SW039	06/27/88	Metal	SW032	08/20/86	Pesticide	SW032	08/20/86	Metal	INT. DITCH	8/8/1990	Metal	INT. DITCH	8/8/1990	Metal
SW039	06/27/88	Radionuclide	SW039	06/27/88	Radionuclide	SW032	08/20/86	Radionuclide	SW032	05/26/87	Metal	INT. DITCH	8/8/1990	Radionuclide	INT. DITCH	8/8/1990	Radionuclide
SW039	06/27/88	VOC	SW039	04/06/89	Metal	SW032	08/20/86	SVOC	SW032	07/30/87	Metal	INT. DITCH	8/8/1990	VOC	SW036	8/20/1986	Metal
SW039	06/27/88	WQP	SW039	04/06/89	Radionuclide	SW032	08/20/86	VOC	SW032	06/21/88	Metal	INT. DITCH	8/8/1990	WQP	SW036	6/27/1988	Metal
SW039	04/06/89	Metal	SW039	05/26/89	Metal	SW032	08/20/86	WQP	SW032	06/21/88	Radionuclide	INT. DITCH	8/24/1992	VOC	SW036	6/27/1988	Radionuclide
SW039	04/06/89	Pesticide	SW039	06/16/89	Metal	SW032	05/26/87	Radionuclide	SW032	04/05/89	Metal	SW036	8/20/1986	Pesticide	SW036	4/3/1989	Metal
SW039	04/06/89	Radionuclide	SW039	11/17/89	Metal	SW032	05/26/87	VOC	SW032	04/05/89	Radionuclide	SW036	8/20/1986	Radionuclide	SW036	4/3/1989	Radionuclide
SW039	04/06/89	SVOC	SW039	12/20/89	Metal	SW032	05/26/87	WQP	SW032	06/21/89	Metal	SW036	8/20/1986	SVOC	SW036	6/28/1989	Metal
SW039	04/06/89	VOC	SW039	01/17/90	Metal	SW032	07/30/87	VOC	SW032	07/19/89	Metal	SW036	8/20/1986	VOC	SW036	9/22/1989	Metal
SW039	04/06/89	WQP	SW039	02/08/90	Metal	SW032	07/30/87	WQP	SW032	08/04/89	Metal	SW036	8/20/1986	WQP	SW036	10/19/1989	Metal
SW039	05/26/89	Metal	SW039	03/21/90	Metal	SW032	11/11/87	VOC	SW032	10/13/89	Metal	SW036	6/27/1988	Metal	SW036	11/9/1989	Metal
SW039	05/26/89	Pesticide	SW039	04/12/90	Metal	SW032	06/21/88	Metal	SW032	12/15/89	Metal	SW036	6/27/1988	Radionuclide	SW036	12/14/1989	Metal
SW039	05/26/89	Radionuclide	SW039	04/12/90	Radionuclide	SW032	06/21/88	Radionuclide	SW032	01/16/90	Metal	SW036	6/27/1988	VOC	SW036	1/12/1990	Metal
SW039	05/26/89	SVOC	SW039	05/09/90	Metal	SW032	06/21/88	VOC	SW032	03/23/90	Metal	SW036	6/27/1988	WQP	SW036	2/9/1990	Metal
SW039	05/26/89	VOC	SW039	06/07/90	Metal	SW032	06/21/88	WQP	SW032	04/11/90	Metal	SW036	4/3/1989	Metal	SW036	3/14/1990	Metal
SW039	05/26/89	WQP	SW039	07/16/90	Radionuclide	SW032	04/05/89	Metal	SW032	04/11/90	Radionuclide	SW036	4/3/1989	Pesticide	SW036	4/12/1990	Metal
SW039	06/16/89	Metal	SW039	08/15/90	Radionuclide	SW032	04/05/89	Pesticide	SW032	05/10/90	Metal	SW036	4/3/1989	Radionuclide	SW036	4/12/1990	Radionuclide
SW039	06/16/89	Radionuclide	SW039	09/13/90	Metal	SW032	04/05/89	Radionuclide	SW032	07/16/90	Radionuclide	SW036	4/3/1989	SVOC	SW036	5/14/1990	Metal
SW039	06/16/89	VOC	SW039	10/02/90	Metal	SW032	04/05/89	SVOC	SW032	08/09/90	Metal	SW036	4/3/1989	VOC	SW036	6/7/1990	Metal
SW039	06/16/89	WQP	SW039	11/08/90	Metal	SW032	04/05/89	VOC	SW032	09/13/90	Metal	SW036	4/3/1989	WQP	SW036	8/8/1990	Metal
SW039	11/17/89	Metal	SW039	11/08/90	Radionuclide	SW032	04/05/89	WQP	SW032	10/04/90	Metal	SW036	5/24/1989	Pesticide	SW036	8/8/1990	Radionuclide
SW039	11/17/89	Radionuclide	SW039	12/04/90	Metal	SW032	05/24/89	Pesticide	SW032	11/07/90	Metal	SW036	5/24/1989	Radionuclide	SW036	11/20/1990	Metal
SW039	11/17/89	VOC	SW039	12/04/90	Radionuclide	SW032	05/24/89	Radionuclide	SW032	11/07/90	Radionuclide	SW036	5/24/1989	WQP	SW036	11/20/1990	Radionuclide
SW039	12/20/89	Metal	SW039	03/28/91	Metal	SW032	05/24/89	WQP	SW032	12/04/90	Metal	SW036	6/28/1989	Metal	SW036	3/15/1991	Metal
SW039	12/20/89	Radionuclide	SW039	03/28/91	Radionuclide	SW032	06/21/89	Metal	SW032	12/04/90	Radionuclide	SW036	6/28/1989	Radionuclide	SW036	3/15/1991	Radionuclide
SW039	12/20/89	VOC	SW039	04/01/91	Metal	SW032	06/21/89	Radionuclide	SW032	03/13/91	Metal	SW036	6/28/1989	VOC	SW036	4/8/1991	Metal
SW039	12/20/89	WQP	SW039	04/01/91	Radionuclide	SW032	06/21/89	VOC	SW032	03/13/91	Radionuclide	SW036	6/28/1989	WQP	SW036	4/8/1991	Radionuclide
SW039	01/17/90	Metal	SW039	05/03/91	Metal	SW032	06/21/89	WQP	SW032	04/04/91	Metal	SW036	9/22/1989	Metal	SW036	5/16/1991	Metal
SW039	01/17/90	Radionuclide	SW039	05/03/91	Radionuclide	SW032	07/19/89	Metal	SW032	04/04/91	Radionuclide	SW036	9/22/1989	Radionuclide	SW036	5/16/1991	Radionuclide
SW039	01/17/90	VOC	SW039	06/04/91	Metal	SW032	07/19/89	Radionuclide	SW032	05/09/91	Metal	SW036	9/22/1989	VOC	SW036	8/13/1991	Metal
SW039	01/17/90	WQP	SW039	06/04/91	Radionuclide	SW032	07/19/89	VOC	SW032	05/09/91	Radionuclide	SW036	9/22/1989	WQP	SW036	8/13/1991	Radionuclide
SW039	02/08/90	Metal	SW039	07/08/91	Metal	SW032	07/19/89	WQP	SW032	06/13/91	Metal	SW036	10/19/1989	Metal	SW036	11/7/1991	Metal
SW039	02/08/90	Radionuclide	SW039	07/08/91	Radionuclide	SW032	08/04/89	Metal	SW032	06/13/91	Radionuclide	SW036	10/19/1989	Radionuclide	SW036	4/8/1992	Metal
SW039	02/08/90	VOC	SW039	08/05/91	Metal	SW032	08/04/89	Radionuclide	SW032	07/10/91	Metal	SW036	10/19/1989	SVOC.	SW036	8/25/1992	Metal
SW039	02/08/90	WQP	SW039	09/05/91	Metal	SW032	08/04/89	WQP	SW032	07/10/91	Radionuclide	SW036	10/19/1989	VOC	SW038	11/5/1990	Metal
SW039	03/21/90	Metal	SW039	10/02/91	Metal	SW032	09/19/89	Metal	SW032	08/07/91	Metal	SW036	11/9/1989	Metal	SW038	11/5/1990	Radionuclide
SW039	03/21/90	Radionuclide	SW039	11/18/91	Metal	SW032	09/19/89	Radionuclide	SW032	08/07/91	Radionuclide	SW036	11/9/1989	VOC	SW038	12/11/1990	Metal
SW039	03/21/90	VOC	SW039	04/15/92	Metal	SW032	09/19/89	VOC	SW032	09/26/91	Metal	SW036	12/14/1989	Metal	SW038	12/11/1990	Radionuclide
SW039	03/21/90	WQP	SW040	07/30/87	Metal	SW032	09/19/89	WQP	SW032	10/10/91	Metal	SW036	12/14/1989	Radionuclide	SW038	3/28/1991	Metal
SW039	04/12/90		SW040	11/04/92	Metal	SW032	10/13/89	Metal	SW032	11/13/91	Metal	SW036	12/14/1989	WQP	SW038	3/28/1991	Radionuclide
SW039	04/12/90	Metal	SW040	11/04/92	Radionuclide	SW032	10/13/89	Pesticide	SW032	01/15/92	Metal	SW036	1/12/1990	Metal	SW038	4/9/1991	Metal
SW039	04/12/90	Pesticide	SW040	03/24/93	Metal	SW032	10/13/89	Radionuclide	SW032	01/15/92	Radionuclide	SW036	1/12/1990	Radionuclide	SW038	4/9/1991	Radionuclide
SW039	04/12/90	Radionuclide	SW040	03/24/93	Radionuclide	SW032	10/13/89	SVOC	SW032	04/02/92	Metal	SW036	1/12/1990	VOC	SW038	5/16/1991	Metal
SW039	04/12/90	SVOC	SW041	07/29/87	Metal	SW032	10/13/89	VOC	SW033	07/01/88	Metal	SW036	1/12/1990	WQP	SW038	5/16/1991	Radionuclide
SW039	04/12/90	VOC	SW041	03/01/89	Metal	SW032	12/15/89	Metal	SW033	07/01/88	Radionuclide	SW036	2/9/1990	Radionuclide	SW038	6/20/1991	Metal
SW039	04/12/90	WQP	SW041	03/01/89	Radionuclide	SW032	12/15/89	Radionuclide	SW033	04/04/89	Metal	SW036	2/9/1990	VOC	SW038	6/20/1991	Radionuclide
SW039	05/09/90	Metal	SW041	05/26/89	Metal	SW032	12/15/89	VOC	SW033	04/04/89	Radionuclide	SW036	2/9/1990	WQP	SW038	7/25/1991	Metal
SW039	05/09/90	Radionuclide	SW041	06/16/89	Metal	SW032	12/15/89	WQP	SW033	06/21/89	Metal	SW036	3/14/1990	Metal	SW038	7/25/1991	Radionuclide
SW039	05/09/90	VOC	SW041	11/20/89	Metal	SW032	01/16/90	Metal	SW033	09/19/89	Metal	SW036	3/14/1990	Radionuclide	SW038	8/28/1991	Metal
SW039	05/09/90	WQP	SW041	12/05/89	Metal	SW032	01/16/90	Radionuclide	SW033	10/13/89	Metal	SW036	3/14/1990	VOC	SW038	9/18/1991	Metal
SW039	06/07/90	Metal	SW041	01/04/90	Metal	SW032	01/16/90	VOC	SW033	12/15/89	Metal	SW036	4/12/1990	Pesticide	SW038	10/23/1991	Metal
SW039	06/07/90	Radionuclide	SW041	02/06/90	Metal	SW032	01/16/90	WQP	SW033	01/16/90	Metal	SW036	4/12/1990	Radionuclide	SW038	11/7/1991	Metal
SW039	06/07/90	VOC	SW041	02/06/90	Radionuclide	SW032	02/20/90	Radionuclide	SW033	03/23/90	Metal	SW036	5/14/1990	Metal	SW038	1/20/1992	Metal
SW039	06/07/90	WQP	SW041	03/21/90	Metal	SW032	02/20/90	VOC	SW033	04/11/90	Metal	SW036	5/14/1990	Radionuclide	SW038	4/7/1992	Metal
SW039	07/16/90	Radionuclide	SW041	04/05/90	Metal	SW032	03/23/90	Metal	SW033	04/11/90	Radionuclide	SW036	5/14/1990	VOC	SW038	8/10/1992	Metal
SW039	07/16/90	VOC	SW041	05/02/90	Metal	SW032	03/23/90	Radionuclide	SW033	05/10/90	Metal	SW036	5/14/1990	WQP	SW129	11/5/1990	Metal
SW039	07/16/90	WQP	SW041	06/04/90	Metal	SW032	03/23/90	VOC	SW033	06/07/90	Metal	SW036	6/7/1990	Metal	SW129	11/5/1990	Radionuclide
SW039	08/15/90	Radionuclide	SW041	07/05/90	Metal	SW032	04/11/90		SW033	07/16/90	Radionuclide	SW036.	6/7/1990	Radionuclide	SW129	12/6/1990	Metal
SW039	09/13/90	Metal	SW041	07/05/90	Radionuclide	SW032	04/11/90	Metal	SW033	08/14/90	Radionuclide	SW036	6/7/1990	VOC	SW129	12/6/1990	Radionuclide
SW039	09/13/90	Radionuclide	SW041	08/06/90	Metal	SW032	04/11/90	Pesticide	SW033	09/13/90	Metal	SW036	6/7/1990	WQP	SW129	3/28/1991	Metal
SW039	09/13/90	WQP	SW041	08/06/90	Radionuclide	SW032	04/11/90	SVOC	SW033	10/04/90	Metal	SW036	8/8/1990	Metal	SW129	3/28/1991	Radionuclide
SW039	10/02/90	Metal	SW041	09/05/90	Metal	SW032	04/11/90	VOC	SW033	11/07/90	Metal	SW036	8/8/1990	Radionuclide	SW129	4/9/1991	Metal
SW039	10/02/90	Pesticide	SW041	10/02/90	Metal	SW032	04/11/90	WQP	SW033	11/07/90	Radionuclide	SW036	8/8/1990	VOC	SW129	4/9/1991	Radionuclide
SW039	10/02/90	SVOC	SW041	12/04/90	Metal	SW032	05/10/90	Metal	SW033	12/04/90	Metal	SW036	8/8/1990	WQP	SW129	5/16/1991	Metal
SW039	10/02/90	VOC	SW041	12/04/90	Radionuclide	SW032	05/10/90	Radionuclide	SW033	12/04/90	Radionuclide	SW036	11/20/1990	Metal	SW129	5/16/1991	Radionuclide
SW039	10/02/90	WQP	SW041	05/03/91	Metal	SW032	05/10/90	VOC	SW033	03/08/91	Metal	SW036	11/20/1990	Radionuclide	SW129	6/26/1991	Metal
SW039	11/08/90	Metal	SW041	05/03/91	Radionuclide	SW032	05/10/90	WQP	SW033	04/04/91	Metal	SW036	11/20/1990	VOC	SW129	6/26/1991	Radionuclide

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Table 3.
Sampling and Analytical Summary for OLF Surface Water

SW039	11/08/90	Radionuclide
SW039	11/08/90	VOC
SW039	11/08/90	WQP
SW039	12/04/90	Metal
SW039	12/04/90	Radionuclide
SW039	12/04/90	VOC
SW039	12/04/90	WQP
SW039	03/28/91	Metal
SW039	03/28/91	Radionuclide
SW039	03/28/91	VOC
SW039	03/28/91	WQP
SW039	04/01/91	Metal
SW039	04/01/91	Pesticide
SW039	04/01/91	Radionuclide
SW039	04/01/91	SVOC
SW039	04/01/91	VOC
SW039	04/01/91	WQP
SW039	05/03/91	Metal
SW039	05/03/91	Radionuclide
SW039	05/03/91	VOC
SW039	05/03/91	WQP
SW039	06/04/91	Metal
SW039	06/04/91	Radionuclide
SW039	06/04/91	VOC
SW039	06/04/91	WQP
SW039	07/08/91	Metal
SW039	07/08/91	Radionuclide
SW039	07/08/91	VOC
SW039	07/08/91	WQP
SW039	08/05/91	Metal
SW039	08/05/91	VOC
SW039	08/05/91	WQP
SW039	09/05/91	Metal
SW039	09/05/91	Radionuclide
SW039	09/05/91	VOC
SW039	09/05/91	WQP
SW039	10/02/91	Metal
SW039	10/02/91	Pesticide
SW039	10/02/91	Radionuclide
SW039	10/02/91	SVOC
SW039	10/02/91	VOC
SW039	10/02/91	WQP
SW039	11/18/91	Metal
SW039	11/18/91	Radionuclide
SW039	11/18/91	VOC
SW039	11/18/91	WQP
SW039	04/15/92	Metal
SW039	04/15/92	VOC
SW039	04/15/92	WQP
SW040	07/30/87	VOC
SW040	07/30/87	WQP
SW040	11/04/92	Metal
SW040	11/04/92	Pesticide
SW040	11/04/92	Radionuclide
SW040	11/04/92	SVOC
SW040	11/04/92	VOC
SW040	11/04/92	WQP
SW040	03/24/93	Metal
SW040	03/24/93	Pesticide
SW040	03/24/93	Radionuclide
SW040	03/24/93	SVOC
SW040	03/24/93	VOC
SW040	03/24/93	WQP
SW041	07/29/87	VOC
SW041	07/29/87	WQP
SW041	11/11/87	VOC
SW041	03/01/89	Metal
SW041	03/01/89	Radionuclide
SW041	03/01/89	WQP
SW041	05/26/89	Metal
SW041	06/04/91	Metal
SW041	06/04/91	Radionuclide
SW041	07/08/91	Metal
SW041	07/08/91	Radionuclide
SW041	08/05/91	Metal
SW041	08/05/91	Radionuclide
SW041	09/05/91	Metal
SW041	10/02/91	Metal
SW041	12/17/92	Metal
SW041	03/24/93	Metal
SW041	03/24/93	Radionuclide
SW032	07/16/90	Radionuclide
SW032	07/16/90	VOC
SW032	07/16/90	WQP
SW032	08/09/90	Metal
SW032	08/09/90	Radionuclide
SW032	08/09/90	VOC
SW032	08/09/90	WQP
SW032	09/13/90	Metal
SW032	09/13/90	Radionuclide
SW032	09/13/90	WQP
SW032	10/04/90	Metal
SW032	10/04/90	Radionuclide
SW032	10/04/90	SVOC
SW032	10/04/90	VOC
SW032	10/04/90	WQP
SW032	11/07/90	Metal
SW032	11/07/90	Radionuclide
SW032	11/07/90	VOC
SW032	11/07/90	WQP
SW032	12/04/90	Metal
SW032	12/04/90	Radionuclide
SW032	12/04/90	VOC
SW032	12/04/90	WQP
SW032	03/13/91	Metal
SW032	03/13/91	Radionuclide
SW032	03/13/91	VOC
SW032	03/13/91	WQP
SW032	04/04/91	Metal
SW032	04/04/91	Pesticide
SW032	04/04/91	Radionuclide
SW032	04/04/91	SVOC
SW032	04/04/91	VOC
SW032	04/04/91	WQP
SW032	05/09/91	Metal
SW032	05/09/91	Radionuclide
SW032	05/09/91	VOC
SW032	05/09/91	WQP
SW032	06/13/91	Metal
SW032	06/13/91	Radionuclide
SW032	06/13/91	VOC
SW032	06/13/91	WQP
SW032	07/10/91	Metal
SW032	07/10/91	Radionuclide
SW032	07/10/91	VOC
SW032	07/10/91	WQP
SW032	08/07/91	Metal
SW032	08/07/91	Radionuclide
SW032	08/07/91	VOC
SW032	08/07/91	WQP
SW032	09/26/91	Metal
SW032	09/26/91	Radionuclide
SW032	09/26/91	VOC
SW032	09/26/91	WQP
SW032	10/10/91	Metal
SW032	10/10/91	Pesticide
SW032	10/10/91	Radionuclide
SW032	10/10/91	SVOC
SW032	10/10/91	VOC
SW032	10/10/91	WQP
SW032	11/13/91	Metal
SW032	11/13/91	Radionuclide
SW032	11/13/91	VOC
SW032	11/13/91	WQP
SW032	01/15/92	Metal
SW032	01/15/92	Radionuclide
SW032	01/15/92	VOC
SW032	01/15/92	WQP
SW032	04/02/92	Metal
SW032	04/02/92	VOC
SW032	04/02/92	WQP
SW033	04/04/91	Radionuclide
SW033	05/13/91	Metal
SW033	05/13/91	Radionuclide
SW033	06/13/91	Metal
SW033	06/13/91	Radionuclide
SW033	07/10/91	Metal
SW033	07/10/91	Radionuclide
SW033	08/07/91	Metal
SW033	08/07/91	Radionuclide
SW033	09/26/91	Metal
SW033	10/10/91	Metal
SW033	11/13/91	Metal
SW033	01/15/92	Metal
SW033	01/15/92	Radionuclide
SW033	04/06/92	Metal
SW033	11/04/92	Metal
SW033	11/04/92	Radionuclide
SW033	03/24/93	Metal
SW033	03/24/93	Radionuclide
SW10295	07/03/95	Metal
SW50193	03/24/93	Metal
SW50193	03/24/93	Radionuclide
SW50293	03/24/93	Metal
SW50293	03/24/93	Radionuclide
SW036	11/20/1990	WQP
SW036	3/15/1991	Metal
SW036	3/15/1991	Radionuclide
SW036	3/15/1991	VOC
SW036	3/15/1991	WQP
SW036	4/8/1991	Metal
SW036	4/8/1991	Pesticide
SW036	4/8/1991	Radionuclide
SW036	4/8/1991	SVOC
SW036	4/8/1991	VOC
SW036	4/8/1991	WQP
SW036	5/16/1991	Metal
SW036	5/16/1991	Radionuclide
SW036	5/16/1991	WQP
SW036	8/13/1991	Metal
SW036	8/13/1991	Radionuclide
SW036	8/13/1991	VOC
SW036	8/13/1991	WQP
SW036	11/7/1991	Metal
SW036	11/7/1991	Radionuclide
SW036	11/7/1991	VOC
SW036	11/7/1991	WQP
SW036	4/8/1992	Metal
SW036	4/8/1992	VOC
SW036	4/8/1992	WQP
SW036	8/25/1992	Metal
SW036	8/25/1992	VOC
SW036	8/25/1992	WQP
SW036	4/18/1994	Metal
SW036	4/18/1994	Pesticide
SW036	4/18/1994	Radionuclide
SW036	4/18/1994	SVOC
SW036	4/18/1994	VOC
SW036	4/18/1994	WQP
SW036	3/23/1995	Metal
SW036	3/23/1995	Pesticide
SW036	3/23/1995	Radionuclide
SW036	3/23/1995	SVOC
SW036	3/23/1995	VOC
SW036	3/23/1995	WQP
SW036	6/1/1995	Metal
SW036	6/1/1995	Pesticide
SW036	6/1/1995	Radionuclide
SW036	6/1/1995	SVOC
SW036	6/1/1995	VOC
SW036	6/1/1995	WQP
SW036	3/17/2003	Metal
SW036	3/17/2003	Radionuclide
SW036	3/22/2003	Metal
SW036	3/22/2003	Radionuclide
SW036	3/25/2003	Metal
SW036	3/25/2003	Radionuclide
SW036	3/27/2003	Metal
SW036	3/27/2003	Radionuclide
SW036	4/1/2003	Metal
SW036	4/1/2003	Radionuclide
SW036	4/3/2003	Metal
SW036	4/3/2003	Radionuclide
SW036	4/7/2003	Metal
SW036	4/7/2003	Radionuclide
SW036	4/14/2003	Metal
SW036	4/14/2003	Radionuclide
SW036	4/19/2003	Metal
SW036	4/19/2003	Radionuclide
SW036	4/22/2003	Metal
SW036	4/22/2003	Radionuclide
SW036	4/28/2003	Metal
SW036	4/28/2003	Radionuclide
SW036	5/10/2003	Metal
SW036	5/10/2003	Radionuclide
SW129	7/22/1991	Metal
SW129	7/22/1991	Radionuclide
SW129	8/13/1991	Metal
SW129	8/13/1991	Radionuclide
SW129	9/18/1991	Metal
SW129	10/23/1991	Metal
SW500	10/5/1992	Metal
SW500	10/5/1992	Radionuclide

Table 3.
Sampling and Analytical Summary for OLF Surface Water

SW041	05/26/89	Radionuclide
SW041	05/26/89	WQP
SW041	06/16/89	Metal
SW041	06/16/89	Radionuclide
SW041	06/16/89	WQP
SW041	11/20/89	Metal
SW041	11/20/89	Radionuclide
SW041	11/20/89	WQP
SW041	12/05/89	Metal
SW041	12/05/89	Radionuclide
SW041	12/05/89	WQP
SW041	01/04/90	Metal
SW041	01/04/90	Radionuclide
SW041	01/04/90	WQP
SW041	02/06/90	Metal
SW041	02/06/90	Radionuclide
SW041	02/06/90	WQP
SW041	03/21/90	Metal
SW041	03/21/90	Radionuclide
SW041	03/21/90	WQP
SW041	04/05/90	
SW041	04/05/90	Metal
SW041	04/05/90	Pesticide
SW041	04/05/90	SVOC
SW041	04/05/90	VOC
SW041	04/05/90	WQP
SW041	05/02/90	Metal
SW041	05/02/90	Radionuclide
SW041	05/02/90	VOC
SW041	05/02/90	WQP
SW041	06/04/90	Metal
SW041	06/04/90	Radionuclide
SW041	06/04/90	VOC
SW041	06/04/90	WQP
SW041	07/05/90	Metal
SW041	07/05/90	Radionuclide
SW041	07/05/90	VOC
SW041	07/05/90	WQP
SW041	08/06/90	Metal
SW041	08/06/90	Radionuclide
SW041	08/06/90	VOC
SW041	08/06/90	WQP
SW041	09/05/90	Metal
SW041	09/05/90	Radionuclide
SW041	09/05/90	VOC
SW041	09/05/90	WQP
SW041	10/02/90	Metal
SW041	10/02/90	Pesticide
SW041	10/02/90	SVOC
SW041	10/02/90	VOC
SW041	10/02/90	WQP
SW041	12/04/90	Metal
SW041	12/04/90	Radionuclide
SW041	12/04/90	VOC
SW041	12/04/90	WQP
SW041	05/03/91	Metal
SW041	05/03/91	Radionuclide
SW041	05/03/91	VOC
SW041	05/03/91	WQP
SW041	06/04/91	Metal
SW041	06/04/91	Radionuclide
SW041	06/04/91	VOC
SW041	06/04/91	WQP
SW041	07/08/91	Metal
SW041	07/08/91	Radionuclide
SW041	07/08/91	VOC
SW041	07/08/91	WQP
SW041	08/05/91	Metal
SW041	08/05/91	Radionuclide
SW041	08/05/91	VOC

SW033	07/01/88	Metal
SW033	07/01/88	Radionuclide
SW033	07/01/88	VOC
SW033	07/01/88	WQP
SW033	04/04/89	Metal
SW033	04/04/89	Pesticide
SW033	04/04/89	Radionuclide
SW033	04/04/89	SVOC
SW033	04/04/89	VOC
SW033	04/04/89	WQP
SW033	05/24/89	Pesticide
SW033	05/24/89	Radionuclide
SW033	05/24/89	WQP
SW033	06/21/89	Metal
SW033	06/21/89	Radionuclide
SW033	06/21/89	VOC
SW033	06/21/89	WQP
SW033	09/19/89	Metal
SW033	09/19/89	Radionuclide
SW033	09/19/89	VOC
SW033	09/19/89	WQP
SW033	10/13/89	Metal
SW033	10/13/89	Pesticide
SW033	10/13/89	Radionuclide
SW033	10/13/89	SVOC
SW033	10/13/89	VOC
SW033	12/15/89	Metal
SW033	12/15/89	Radionuclide
SW033	12/15/89	VOC
SW033	12/15/89	WQP
SW033	01/16/90	Metal
SW033	01/16/90	Radionuclide
SW033	01/16/90	VOC
SW033	01/16/90	WQP
SW033	02/20/90	Radionuclide
SW033	02/20/90	VOC
SW033	03/23/90	Metal
SW033	03/23/90	Radionuclide
SW033	03/23/90	VOC
SW033	04/11/90	
SW033	04/11/90	Metal
SW033	04/11/90	Pesticide
SW033	04/11/90	Radionuclide
SW033	04/11/90	SVOC
SW033	04/11/90	VOC
SW033	04/11/90	WQP
SW033	05/10/90	Metal
SW033	05/10/90	Radionuclide
SW033	05/10/90	VOC
SW033	05/10/90	WQP
SW033	06/07/90	Metal
SW033	06/07/90	Radionuclide
SW033	06/07/90	VOC
SW033	06/07/90	WQP
SW033	07/16/90	Radionuclide
SW033	07/16/90	VOC
SW033	07/16/90	WQP
SW033	08/14/90	Radionuclide
SW033	09/13/90	Metal
SW033	09/13/90	Radionuclide
SW033	09/13/90	WQP
SW033	10/04/90	Metal
SW033	10/04/90	Radionuclide
SW033	10/04/90	SVOC
SW033	10/04/90	VOC
SW033	10/04/90	WQP
SW033	11/07/90	Metal
SW033	11/07/90	Radionuclide
SW033	11/07/90	VOC
SW033	11/07/90	WQP

SW036	5/20/2003	Metal
SW036	5/20/2003	Radionuclide
SW036	7/18/2003	Metal
SW036	7/18/2003	Radionuclide
SW036	4/26/2004	Metal
SW036	4/26/2004	Radionuclide
SW036	5/12/2004	Metal
SW036	5/12/2004	Radionuclide
SW036	6/17/2004	Metal
SW036	6/17/2004	Radionuclide
SW038	10/15/1990	Metal
SW038	10/15/1990	Pesticide
SW038	10/15/1990	Radionuclide
SW038	10/15/1990	SVOC
SW038	10/15/1990	VOC
SW038	10/15/1990	WQP
SW038	11/5/1990	Metal
SW038	11/5/1990	Radionuclide
SW038	11/5/1990	VOC
SW038	11/5/1990	WQP
SW038	12/11/1990	Metal
SW038	12/11/1990	Radionuclide
SW038	12/11/1990	VOC
SW038	12/11/1990	WQP
SW038	3/28/1991	Metal
SW038	3/28/1991	Radionuclide
SW038	3/28/1991	VOC
SW038	3/28/1991	WQP
SW038	4/9/1991	Metal
SW038	4/9/1991	Pesticide
SW038	4/9/1991	Radionuclide
SW038	4/9/1991	SVOC
SW038	4/9/1991	VOC
SW038	4/9/1991	WQP
SW038	5/16/1991	Metal
SW038	5/16/1991	Radionuclide
SW038	5/16/1991	VOC
SW038	5/16/1991	WQP
SW038	6/20/1991	Metal
SW038	6/20/1991	Radionuclide
SW038	6/20/1991	VOC
SW038	6/20/1991	WQP
SW038	7/25/1991	Metal
SW038	7/25/1991	Radionuclide
SW038	7/25/1991	VOC
SW038	7/25/1991	WQP
SW038	8/28/1991	Metal
SW038	8/28/1991	Radionuclide
SW038	8/28/1991	VOC
SW038	8/28/1991	WQP
SW038	9/18/1991	Metal
SW038	9/18/1991	Radionuclide
SW038	9/18/1991	VOC
SW038	9/18/1991	WQP
SW038	10/23/1991	Metal
SW038	10/23/1991	Pesticide
SW038	10/23/1991	Radionuclide
SW038	10/23/1991	SVOC
SW038	10/23/1991	VOC
SW038	10/23/1991	WQP
SW038	11/7/1991	Metal
SW038	11/7/1991	Radionuclide
SW038	11/7/1991	VOC
SW038	11/7/1991	WQP
SW038	1/20/1992	Metal
SW038	1/20/1992	Radionuclide
SW038	1/20/1992	VOC
SW038	1/20/1992	WQP
SW038	4/7/1992	Metal
SW038	4/7/1992	VOC

Table 3.
Sampling and Analytical Summary for OLF Surface Water

SW041	08/05/91	WQP
SW041	09/05/91	Metal
SW041	09/05/91	Radionuclide
SW041	09/05/91	VOC
SW041	09/05/91	WQP
SW041	10/02/91	Metal
SW041	10/02/91	Pesticide
SW041	10/02/91	Radionuclide
SW041	10/02/91	SVOC
SW041	10/02/91	VOC
SW041	10/02/91	WQP
SW041	12/17/92	Metal
SW041	12/17/92	Radionuclide
SW041	12/17/92	VOC
SW041	12/17/92	WQP
SW041	03/24/93	Metal
SW041	03/24/93	Pesticide
SW041	03/24/93	Radionuclide
SW041	03/24/93	SVOC
SW041	03/24/93	VOC
SW041	03/24/93	WQP

SW033	12/04/90	Metal
SW033	12/04/90	Radionuclide
SW033	12/04/90	VOC
SW033	12/04/90	WQP
SW033	03/08/91	Metal
SW033	03/08/91	Radionuclide
SW033	03/08/91	VOC
SW033	03/08/91	WQP
SW033	04/04/91	Metal
SW033	04/04/91	Pesticide
SW033	04/04/91	Radionuclide
SW033	04/04/91	SVOC
SW033	04/04/91	VOC
SW033	04/04/91	WQP
SW033	05/13/91	Metal
SW033	05/13/91	Radionuclide
SW033	05/13/91	VOC
SW033	05/13/91	WQP
SW033	06/13/91	Metal
SW033	06/13/91	Radionuclide
SW033	06/13/91	VOC
SW033	06/13/91	WQP
SW033	07/10/91	Metal
SW033	07/10/91	Radionuclide
SW033	07/10/91	VOC
SW033	07/10/91	WQP
SW033	08/07/91	Metal
SW033	08/07/91	Radionuclide
SW033	08/07/91	VOC
SW033	08/07/91	WQP
SW033	09/26/91	Metal
SW033	09/26/91	Radionuclide
SW033	09/26/91	VOC
SW033	09/26/91	WQP
SW033	10/10/91	Metal
SW033	10/10/91	Pesticide
SW033	10/10/91	Radionuclide
SW033	10/10/91	SVOC
SW033	10/10/91	VOC
SW033	10/10/91	WQP
SW033	11/13/91	Metal
SW033	11/13/91	Radionuclide
SW033	11/13/91	VOC
SW033	11/13/91	WQP
SW033	01/15/92	Metal
SW033	01/15/92	Radionuclide
SW033	01/15/92	VOC
SW033	01/15/92	WQP
SW033	04/06/92	Metal
SW033	04/06/92	VOC
SW033	04/06/92	WQP
SW033	11/04/92	Metal
SW033	11/04/92	Pesticide
SW033	11/04/92	Radionuclide
SW033	11/04/92	SVOC
SW033	11/04/92	VOC
SW033	11/04/92	WQP
SW033	03/24/93	Metal
SW033	03/24/93	Pesticide
SW033	03/24/93	Radionuclide
SW033	03/24/93	SVOC
SW033	03/24/93	VOC
SW033	03/24/93	WQP
SW10295	07/03/95	Metal
SW10295	07/03/95	VOC
SW10295	07/03/95	WQP
SW50193	03/24/93	Metal
SW50193	03/24/93	Pesticide
SW50193	03/24/93	Radionuclide
SW50193	03/24/93	SVOC

SW038	4/7/1992	WQP
SW038	8/10/1992	Metal
SW038	8/10/1992	Radionuclide
SW038	8/10/1992	VOC
SW038	8/10/1992	WQP
SW038	4/18/1994	Metal
SW038	4/18/1994	Pesticide
SW038	4/18/1994	Radionuclide
SW038	4/18/1994	SVOC
SW038	4/18/1994	VOC
SW038	4/18/1994	WQP
SW038	9/30/1994	Metal
SW038	9/30/1994	Pesticide
SW038	9/30/1994	Radionuclide
SW038	9/30/1994	SVOC
SW038	9/30/1994	VOC
SW038	9/30/1994	WQP
SW038	12/13/1994	Metal
SW038	12/13/1994	Pesticide
SW038	12/13/1994	Radionuclide
SW038	12/13/1994	SVOC
SW038	12/13/1994	VOC
SW038	12/13/1994	WQP
SW038	3/23/1995	Metal
SW038	3/23/1995	Pesticide
SW038	3/23/1995	Radionuclide
SW038	3/23/1995	SVOC
SW038	3/23/1995	VOC
SW038	3/23/1995	WQP
SW038	6/1/1995	Metal
SW038	6/1/1995	Pesticide
SW038	6/1/1995	Radionuclide
SW038	6/1/1995	SVOC
SW038	6/1/1995	VOC
SW038	6/1/1995	WQP
SW038	9/26/1995	Metal
SW038	9/26/1995	Pesticide
SW038	9/26/1995	Radionuclide
SW038	9/26/1995	SVOC
SW038	9/26/1995	VOC
SW038	9/26/1995	WQP
SW038	6/8/2004	Metal
SW038	6/8/2004	Radionuclide
SW038	6/8/2004	SVOC
SW038	6/8/2004	VOC
SW129	10/15/1990	Metal
SW129	10/15/1990	Pesticide
SW129	10/15/1990	Radionuclide
SW129	10/15/1990	SVOC
SW129	10/15/1990	VOC
SW129	10/15/1990	WQP
SW129	11/5/1990	Metal
SW129	11/5/1990	Radionuclide
SW129	11/5/1990	VOC
SW129	11/5/1990	WQP
SW129	12/6/1990	Metal
SW129	12/6/1990	Radionuclide
SW129	12/6/1990	VOC
SW129	12/6/1990	WQP
SW129	3/28/1991	Metal
SW129	3/28/1991	Radionuclide
SW129	3/28/1991	VOC
SW129	3/28/1991	WQP
SW129	4/9/1991	Metal
SW129	4/9/1991	Pesticide
SW129	4/9/1991	Radionuclide
SW129	4/9/1991	SVOC
SW129	4/9/1991	VOC
SW129	4/9/1991	WQP
SW129	5/16/1991	Metal

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Table 3.
Sampling and Analytical Summary for OLF Surface Water

SW50193	03/24/93	VOC
SW50193	03/24/93	WQP
SW50293	03/24/93	Metal
SW50293	03/24/93	Pesticide
SW50293	03/24/93	Radionuclide
SW50293	03/24/93	SVOC
SW50293	03/24/93	VOC
SW50293	03/24/93	WQP

SW129	5/16/1991	Radionuclide
SW129	5/16/1991	VOC
SW129	5/16/1991	WQP
SW129	6/26/1991	Metal
SW129	6/26/1991	Radionuclide
SW129	6/26/1991	VOC
SW129	6/26/1991	WQP
SW129	7/22/1991	Metal
SW129	7/22/1991	Radionuclide
SW129	7/22/1991	VOC
SW129	7/22/1991	WQP
SW129	8/13/1991	Metal
SW129	8/13/1991	Radionuclide
SW129	8/13/1991	VOC
SW129	8/13/1991	WQP
SW129	9/18/1991	Metal
SW129	9/18/1991	Radionuclide
SW129	9/18/1991	VOC
SW129	9/18/1991	WQP
SW129	10/23/1991	Metal
SW129	10/23/1991	Pesticide
SW129	10/23/1991	Radionuclide
SW129	10/23/1991	SVOC
SW129	10/23/1991	VOC
SW129	10/23/1991	WQP
SW500	10/5/1992	Metal
SW500	10/5/1992	Pesticide
SW500	10/5/1992	Radionuclide
SW500	10/5/1992	SVOC
SW500	10/5/1992	VOC
SW500	10/5/1992	WQP

Table 4.
Sampling and Analytical Summary for OLF Sediment

Sediment		
Location Code	Collection Date	Analyte Group
INT. DITCH	4/3/1992	VOC
SED41400	10/4/2000	Radionuclide
SED51693	7/8/1993	Metal
SED51693	7/8/1993	PCB
SED51693	7/8/1993	Pesticide
SED51693	7/8/1993	Radionuclide
SED51693	7/8/1993	SVOC
SED51693	7/8/1993	VOC
SW036	11/29/1993	Metal
SW036	11/29/1993	PCB
SW036	11/29/1993	Pesticide
SW036	11/29/1993	Radionuclide
SW036	11/29/1993	SVOC
SW036	11/29/1993	VOC
SW506	11/5/1992	Metal
SW506	11/5/1992	Radionuclide
SW507	11/5/1992	Metal
SW507	11/5/1992	Radionuclide

Appendix D

Electronic File of Environmental Data

Appendix E

Summary – Removal of Radiologically Contaminated Surface Soil

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Summary
Removal of Radiologically Contaminated Surface Soil
Original Landfill

Rocky Flats Environmental Technology Site
Rev. 1 - October 29, 2004

OVERVIEW

This work involved the removal of surface soil with uranium contamination above the Wildlife Worker Action Levels at four locations within the Original Landfill (see attached figure for locations). Discussion of source and location of the contamination can be found in the Original Landfill IM/IRA section 2.2. Characterization sampling efforts used to define the hot spots are discussed in sections 4.2 and 4.3 of the Original Landfill IM/IRA. The soil excavation was performed in late July 2004.

SCOPE

Preparation

- Straw bales were placed along the up-gradient and down-gradient sides of the planned excavation.
- Empty waste containers were brought into proximity of the planned excavation and placed on plastic sheets.

Remediation

- A sampling program had previously identified four locations of contaminated surface soil. Each location was staked using GPS surveying techniques. A square was drawn on the surface of the soil, with each side of the square extending out 5 feet north, south, east and west from the stake, creating a 10 feet by 10 feet square.
- Soil was then removed to a depth of at least 6-inches with a track-mounted excavator. Equipment was kept out of the excavation to prevent the spread of contamination. A visual inspection was performed to ensure that the entire square had been removed to the required depth. A radiological survey of the excavator was performed following excavation to assure that no contact had been made with contaminated soil.
- Air monitoring was performed throughout the excavation activities by Radiological Operations for worker safety and to ensure no airborne spread of contamination. No readings approaching the suspension limit of 0.3 DAC in RWP 04-RISS-0031 were noted.
- All the removed soil was placed directly into IP-1 waste containers. Each location required two containers for a total of 8 containers generated by the project. Plastic sheets and accumulated soil were emptied and placed into the waste containers. All 8 waste containers are awaiting shipment for disposal at Envirocare in Utah as low-level waste.

Post-Remediation Sampling

- Two composite samples were collected from within 2 inches of the surface following the excavation of each square.
- One composite sample consisted of soil collected from the middle of each of the four sidewalls of the excavation.
- The other composite sample collected following excavation consisted of soil collected from the surface in the northeast, northwest, southeast and southwest quadrants of the floor, and from the center of the floor.
- Both samples were screened with gamma spectrometry and then sent to an off-site lab for alpha spectrometry confirmation analysis.
- Analytical results from all samples were below action levels for all radionuclides.
- All sample locations were flagged and GPS surveyed. The extent of the excavation was also GPS surveyed.

Erosion Control

- Following receipt of the analyses from the field screen of the samples, permanent erosion controls were performed.
- The edges of each of the four excavations were graded to blend into the surrounding grade.
- Additional straw bales were added to completely surround each of the four excavations.
- Erosion (coconut) mat was placed over the exposed soil of the excavations and over soil disturbed by the movement of the equipment.

Analytical Results

The following are the analytical results from before and after remediation at each of the four hot spots:

Original Landfill Hotspots Sites	Alpha Spec — Analytical Results Following Remediation (All in pCi/g)				Analytical Results Prior to Remediation		
	U-234	U-235	U-238		U-234	U-235	U-238
Site 1							
04F1864-001.002	0.854	0.0892	0.962	Wall Composite		46	2000
04F1864-002.002	0.939	0.0632	1.16	Floor Composite			
Site 2							
04F1749-001.002	4.04	0.669	18.9	Wall Composite		19	780
04F1749-002.002	3.82	0.178	20.5	Floor Composite			
Site 3							
04F1749-003.002	2.27	0.248	5.55	Wall Composite		23	1000
04F1749-004.002	4.34	0.399	10.8	Floor Composite			
04F1749-005.002	*3.52*	*0.298*	*9.68*	*Duplicate*			
Site 4							
04F1869-001.002	0.675	0.16	1.44	Wall Composite	2800	670	38000
04F1869-002.002	0.756	0	0.809	Floor Composite			
Wrw_al (Wildlife Refuge Worker Action Level)	300	8	351		300	8	351

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
ER REGULATORY CONTACT RECORD

Date/Time: June 1, 2004 / 1:00 pm

Site Contact(s): Bob Davis
Phone: 303-966-7026

Regulatory Contact: Steve Gunderson & Mark Aguilar
Phone: Steve Gunderson 303-692-3367
Mark Aguilar 303-312-6251

Agency: CDPHE & EPA

Purpose of Contact: Original Landfill Radiologically-Contaminated Surface Soil Removal

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Discussion

Joe Legare (DOE), Mark Aguilar (EPA), Steve Gunderson (CDPHE) and Dave Shelton (KH) discussed the removal of radiologically-contaminated surface soil at the Original Landfill at the June 1, 2004 Project Coordinators' Meeting. Subsequent to this meeting, it was agreed that the removal of radiologically-contaminated surface soil could be conducted at the Site's risk before the Original Landfill IM/IRA was finalized and approved by the regulatory agencies.

The objective of this project is to remove radiological soil contamination from 4 identified hot spots in the Original Landfill. Details of this removal action will be in a work package for this project. An area of soil 10 feet by 10 feet and 6 inches in depth will initially be removed. Excavation will be expanded vertically and laterally until field measurements of soil concentrations of Uranium-234, Uranium-235 and Uranium-238 are below their respective RFCA Wildlife Worker Action Levels. Monitoring will be performed, as necessary, to verify that there has been no release of radiological contamination during the project. Confirmation sampling will be conducted consistent with the IABZSAP. Following the confirmation samples, non-impacted soils from locations adjacent to the excavated areas will be moved to reduce surface slopes and to blend excavated areas into the surrounding surfaces prior to the action for the entire Original Landfill. Erosion controls will be applied to any disturbed surface resulting from the soil removal. This early action accelerates risk reduction, takes advantage of available funding, and uses available resources during favorable weather conditions. It will also provide additional information about the subsurface in this IHSS.

Contact Record Prepared By: Bob Davis

Required Distribution:

M. Aguilar, USEPA
S. Bell, DOE-RFFO
J. Berardini, K-H
R. McCallister, DOE-RFFO
J. Mead, K-H ESS
S. Nesta, K-H RISS

Additional Distribution:

J. MacKenzie, EPA
V. Moritz, EPA

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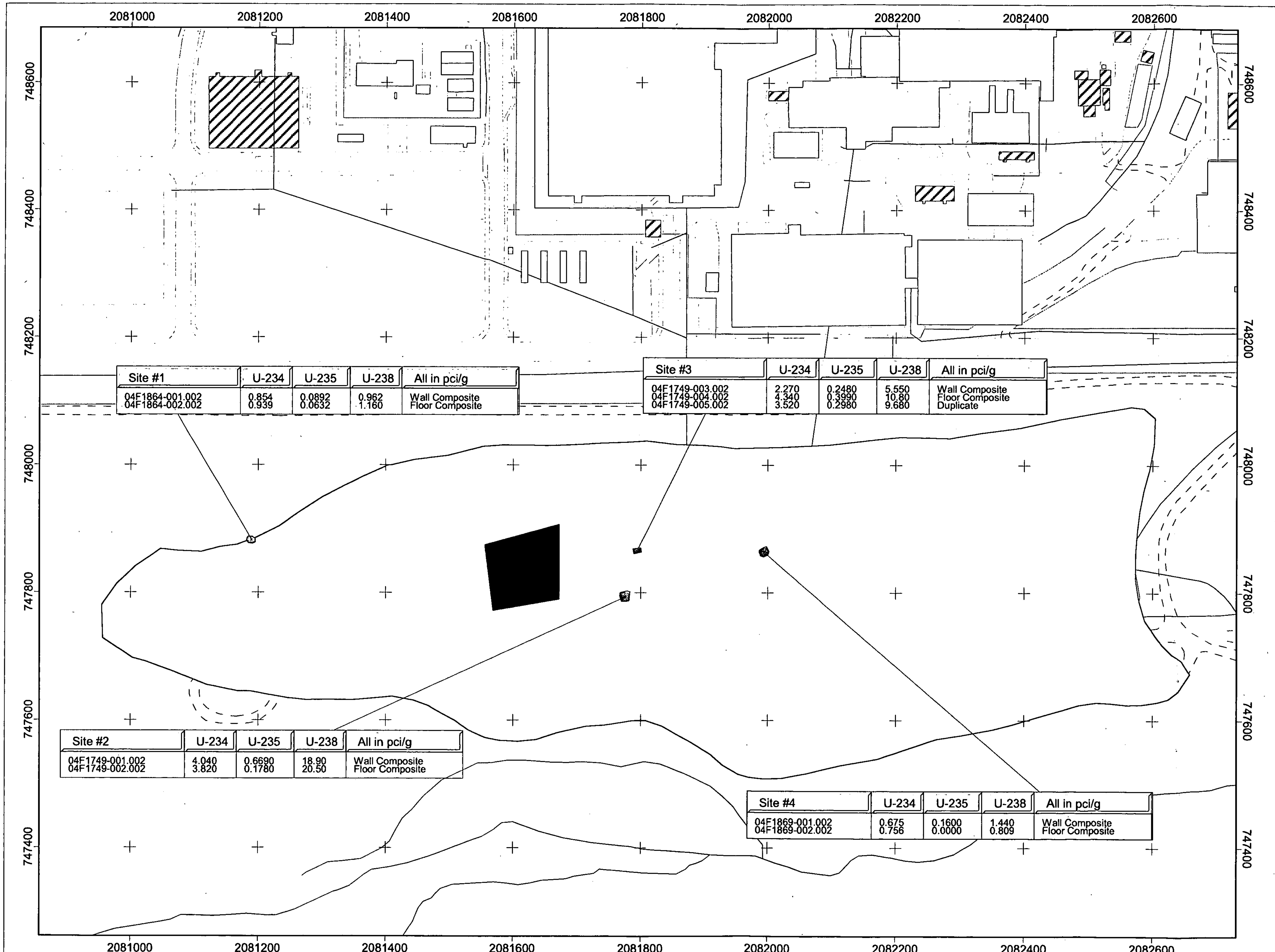
B. Birk, DOE-RFFO	L. Norland, K-H RISS	______
L. Brooks, K-H ESS	K. North, K-H ESS	______
J. Legare, DOE-RFFO	E. Pottorff, CDPHE	______
L. Butler, K-H RISS	A. Primrose, K-H RISS	______
G. Carnival, K-H RISS	R. Schassburger, DOE-RFFO	______
N. Castaneda, DOE-RFFO	S. Serreze, K-H RISS	______
C. Deck, K-H Legal	D. Shelton, K-H ESS	______
S. Gunderson, CDPHE	C. Spreng, CDPHE	______
M. Keating, K-H RISS	S. Surovchak, DOE-RFFO	______
B. Davis, K-H RISS	K. Wiemelt, K-H RISS	______
D. Kruchek, CDPHE	C. Zahm, K-H Legal	______
D. Mayo, K-H RISS		

Surveying within Site 1 of the Original Landfill following excavation.

Original Landfill Site 4 following excavation



Site #1	U-234	U-235	U-238	All in pci/g
04F1864-001.002	0.854	0.0892	0.962	Wall Composite
04F1864-002.002	0.939	0.0632	1.160	Floor Composite

Site #2	U-234	U-235	U-238	All in pci/g
04F1749-001.002	4.040	0.6690	18.90	Wall Composite
04F1749-002.002	3.820	0.1780	20.50	Floor Composite

Site #3	U-234	U-235	U-238	All in pci/g
04F1749-003.002	2.270	0.2480	5.550	Wall Composite
04F1749-004.002	4.340	0.3990	10.80	Floor Composite
04F1749-005.002	3.520	0.2980	9.680	Duplicate

Site #4	U-234	U-235	U-238	All in pci/g
04F1869-001.002	0.675	0.1600	1.440	Wall Composite
04F1869-002.002	0.756	0.0000	0.809	Floor Composite

IHSS Group SW-2 Hot Spot Confirmation Sample Results post Remedial Action

KEY

Surface soil excavation and sampling location

IHSS SW-196

IHSS SW-115

Building

Demolished

Standing

Streams

Paved area

Dirt road

WRW Action Levels:
U-234: 300 pCi/g
U-235: 8 pCi/g
U-238: 351 pCi/g

DRAFT

N

150 0 150

Scale in Feet
1" = 150'
Scale = 1:1800

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Site

Prepared by:

RADMS

Prepared for:

Date: June 2004

KAISER•HILL COMPANY

W:/Project/Fy2004/SW-2/remediation/posthotspotremediation10-19.apr

Appendix F

Accelerated Action Alternatives Cost Estimates

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Original Landfill Accelerated Action Construction Cost Estimate
Alternative 1 - No Action

Rocky Flats Environmental Technology Site

Construction Item	Quantity	Units	Unit Price	Cost	Assumptions/Comments
Mobilization/Demobilization	1	LS	$1,000	$1,000	
Sign Fabrication	22	signs	$500	$11,000	includes signs and posts
Sign Installation	22	signs	$1,000	$22,000	
Vegetation/Erosion Control	5	ac	$2,500	$12,500	Existing Roadway Vegetation
Subtotal				$46,500	
Contingency	15	percent		$6,975	
Construction Project Total (1)				$53,475	with 30% contingency total = $60,450

(1) Construction Project Total does not include construction oversight, QA/QC oversight and testing, preparation of work control documents, design, closure certification document or K-H direct costs.

Operations and Maintenance Costs - *Annual Costs*

Item	Quantity	Units	Unit Rate	Cost	Assumptions/Comments
Weed control	0.00	acres	$150	$0	$150 per acre/year for weed control
Veg. maintenance/ reseeding	0.00	acres	$30	$0	$30 per acre/year for reseeding
Vegetation monitoring - Fieldwork	0	days	$600	$0	1 ecologists x 1 day x 8 hours/day @$75/hour
Vegetation monitoring - Office	0	days	$600	$0	1 ecologists x 1 day x 8 hours/day @$75/hour
Slope Stability Monitoring - Fieldwork	2	days	$800	$1,600	1 engineer x 1 day x 8 hours/day @$100/hour
Slope Stability Momitoring - Office	4	days	$800	$3,200	1 engineer x 1 day x 8 hours/day @$100/hour
Moitoring Well Sampling - Fieldwork	2	days	$1,200	$2,400	1 team x 1 day x 8 hours/day @$150/hour
Monitoring Well Sampling - Office	4	days	$800	$3,200	1 engineer x 1 day x 8 hours/day @$100/hour
Monitoring Well Sampling - Lab	8	samples	$600	$4,800	
Monitoring Well Maintenance	1	LS	$500	$500	
Surface Water Sampling - Fieldwork	2		$1,200	$2,400	1 team x 1 day x 8 hours/day @$150/hour
Surface Water Sampling - Office	4		$800	$3,200	1 engineer x 1 day x 8 hours/day @$100/hour
Surface Water Sampling - Lab	6	samples	$600	$3,600	
Surface Water Station Maintenance	1	LS	$500	$500	
				Total Operations and Maintenance Costs (per year)	**$ 25,400**

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Original Landfill Accelerated Action Construction Cost Estimate
Alternative 2 - Grading with Soil Cover

Rocky Flats Environmental Technology Site

Construction Item	Quantity	Units	Unit Price	Cost	Assumptions/Comments
Mobilization/Demobilization	1	LS	$200,000	$200,000	
Site Preparation (Clear & Grub)	25	acres	$4,000	$100,000	Removal of vegetation & debris
Pregrade Cut	55,000	cy	$6	$330,000	Cut to reach subgrade elevations/slopes
Pregrade Fill	105,000	cy	$14	$1,470,000	Fill to reach subgrade elevations/slopes
Final Grade Preparation	25	acres	$3,000	$75,000	Fine Grading
Soil Cover	65000	cy	$14	$910,000	Rocky Flats Alluvium
Vegetation	30	acres	$6,000	$180,000	Native seeding with crimped straw
Surface Drainage Ditches/Diversion	1	LS	$200,000	$200,000	
Vegetation/Erosion Control	30	ac	$2,500	$75,000	
Subtotal				$3,540,000	
Contingency	15	percent		$531,000	
Construction Project Total (1)				$4,071,000	Total cost with 30% contingency = $4,602,000

(1) Construction Project Total does not include construction oversight, QA/QC oversight and testing, preparation of work control documents, design, closure certification document or K-H direct costs.

Operations and Maintenance Costs - Annual Costs

Item	Quantity	Units	Unit Rate	Cost	Assumptions/Comments
Weed control	25.00	acres	$150	$3,750	$150 per acre/year for weed control
Veg. maintenance/ reseeding	5.00	acres	$30	$150	$30 per acre/year for reseeding
Vegetation monitoring - Fieldwork	1	days	$600	$600	1 ecologists x 1 day x 8 hours/day @$75/hour
Vegetation monitoring - Office	2	days	$600	$1,200	1 ecologists x 1 day x 8 hours/day @$75/hour
Slope Stability Monitoring - Fieldwork	2	days	$800	$1,600	1 engineer x 1 day x 8 hours/day @$100/hour
Slope Stability Momitoring - Office	4	days	$800	$3,200	1 engineer x 1 day x 8 hours/day @$100/hour
Moitoring Well Sampling - Fieldwork	2	days	$1,200	$2,400	1 team x 1 day x 8 hours/day @$150/hour
Monitoring Well Sampling - Office	4	days	$800	$3,200	1 engineer x 1 day x 8 hours/day @$100/hour
Monitoring Well Sampling - Lab	8	samples	$600	$4,800	
Monitoring Well Maintenance	1	LS	$500	$500	
Surface Water Sampling - Fieldwork	2		$1,200	$2,400	1 team x 1 day x 8 hours/day @$150/hour
Surface Water Sampling - Office	4		$800	$3,200	1 engineer x 1 day x 8 hours/day @$100/hour
Surface Water Sampling - Lab	6	samples	$600	$3,600	
Surface Water Station Maintenance	1	LS	$500	$500	
Total Operations and Maintenance Costs (per year)				$ -	31,100

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Original Landfill Accelerated Action Construction Cost Estimate
Alternative 3 - Grading with Soil Cover & Buttress Fill

Rocky Flats Environmental Technology Site

Construction Item	Quantity	Units	Unit Price	Cost	Assumptions/Comments
Mobilization/Demobilization	1	LS	$200,000	$200,000	
Site Preparation (Clear & Grub)	30	acres	$4,000	$120,000	Removal of vegetation & debris
Pregrade Cut	55,000	cy	$6	$330,000	Cut to reach subgrade elevations/slopes
Pregrade Fill	105,000		$14	$1,470,000	Fill to reach subgrade elevations/slopes
Final Grade Preparation	30	acres	$3,000	$90,000	Fine Grading
Buttress Fill	60000	cy	$28	$1,680,000	Structural Fill
Soil Cover	65000	cy	$14	$910,000	Rocky Flats Alluvium
Vegetation	30	acres	$6,000	$180,000	Native seeding with crimped straw
Surface Drainage Ditches/Diversion	1	LS	$200,000	$200,000	
Vegetation/Erosion Control	30	ac	$2,500	$75,000	
Subtotal				$5,255,000	
Contingency	15	percent		$788,250	
Construction Project Total (1)				$6,043,250	Total cost with 30% contingency = $6,831,500

(1) Construction Project Total does not include construction oversight, QA/QC oversight and testing, preparation of work control documents, design, closure certification document or K-H direct costs.

Operations and Maintenance Costs - Annual Costs

Item	Quantity	Units	Unit Rate	Cost	Assumptions/Comments
Weed control	25.00	acres	$150	$3,750	$150 per acre/year for weed control
Veg. maintenance/ reseeding	5.00	acres	$30	$150	$30 per acre/year for reseeding
Vegetation monitoring - fieldwork	1	days	$600	$600	1 ecologists x 1 day x 8 hours/day @$75/hour
Vegetation monitoring - office	2	days	$600	$1,200	1 ecologists x 1 day x 8 hours/day @$75/hour
Slope Stability Monitoring - Fieldwork	2	days	$800	$1,600	1 engineer x 1 day x 8 hours/day @$100/hour
Slope Stability Momitoring - Office	4	days	$800	$3,200	1 engineer x 1 day x 8 hours/day @$100/hour
Moitoring Well Sampling - fieldwork	2	days	$1,200	$2,400	1 team x 1 day x 8 hours/day @$150/hour
Monitoring Well Sampling - Office	4	days	$800	$3,200	1 engineer x 1 day x 8 hours/day @$100/hour
Monitoring Well Sampling - Lab	8	samples	$600	$4,800	
Monitoring Well Maintenance	1	LS	$500	$500	
Surface Water Sampling - Fieldwork	2		$1,200	$2,400	1 team x 1 day x 8 hours/day @$150/hour
Surface Water Sampling - Office	4		$800	$3,200	1 engineer x 1 day x 8 hours/day @$100/hour
Surface Water Sampling - Lab	6	samples	$600	$3,600	
Surface Water Station Maintenance	1	LS	$500	$500	
Total Operations and Maintenance Costs (per year)				$ 31,100	

Original Landfill Accelerated Action Construction Cost Estimate
Alternative 4 - Removal with Offsite Disposal (10% mixed waste & 90% solid waste)

Rocky Flats Environmental Technology Site

Construction Item	Quantity	Units	Unit Price	Cost	Assumptions/Comments
Mobilization/Demobilization	1	LS	$300,000	$300,000	
Site Preparation (Clear & Grub)	30	acres	$4,000	$120,000	Removal of vegetation & debris
Excavation	160,000	cy	$8	$1,280,000	Cut & fill to reach subgrade elevations/slopes
Sampling for Disposal Characterization	1,600	samples	$1,000	$1,600,000	1 sample every 100 cy
Disposal (Offsite, Mixed Waste)	19,200	cy	$4,000	$76,800,000	10
Disposal (Offsite, Soild Waste)	172,800	cy	$40	$6,912,000	90
Pregrade Fill	100,000		$8	$800,000	
Final Grade Preparation	30	acres	$3,000	$90,000	Fine Grading
Vegetation	30	acres	$6,000	$180,000	Native seeding with crimped straw
Surface Drainage Ditches/Diversion	1	LS	$200,000	$200,000	
Vegetation/Erosion Control	30	ac	$2,500	$75,000	
Subtotal				$88,357,000	
Contingency	15	percent		$13,253,550	
Construction Project Total (1)				$101,610,550	Total cost with 30% contingency = $114,864,100

(1) Construction Project Total does not include construction oversight, QA/QC oversight and testing, preparation of work control documents, design, closure certification document or K-H direct costs.

Original Landfill Accelerated Action Construction Cost Estimate
Alternative 4 - Removal with Offsite Disposal (25% mixed waste & 75% solid waste

Rocky Flats Environmental Technology Site

Construction Item	Quantity	Units	Unit Price	Cost	Assumptions/Comments
Mobilization/Demobilization	1	LS	$300,000	$300,000	
Site Preparation (Clear & Grub)	30	acres	$4,000	$120,000	Removal of vegetation & debris
Excavation	160,000	cy	$8	$1,280,000	Cut & fill to reach subgrade elevations/slopes
Sampling for Disposal Characterization	1,600	samples	$1,000	$1,600,000	1 sample every 100 cy
Disposal (Offsite, Mixed Waste)	48,000	cy	$4,000	$192,000,000	25
Disposal (Offsite, Soild Waste)	144,000	cy	$40	$5,760,000	75
Pregrade Fill	100,000		$8	$800,000	
Final Grade Preparation	30	acres	$3,000	$90,000	Fine Grading
Vegetation	30	acres	$6,000	$180,000	Native seeding with crimped straw
Surface Drainage Ditches/Diversion	1	LS	$200,000	$200,000	
Vegetation/Erosion Control	30	ac	$2,500	$75,000	
Subtotal				$202,405,000	
Contingency	15	percent		$30,360,750	
Construction Project Total (1)				$232,765,750	Total cost with 30% contingency = $263,126,500

(1) Construction Project Total does not include construction oversight, QA/QC oversight and testing, preparation of work control documents, design, closure certification document or K-H direct costs.

Appendix G

Wetland Mitigation Plan

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Original Landfill Project Wetland Mitigation Plan For The Rocky Flats Environmental Technology Site

MARCH 2004

CLASSIFICATION EXEMPTION CEX-105-01

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Original Landfill Project Wetland Mitigation Plan

Introduction

The Rocky Flats Environmental Technology Site (the Site) is a U.S. Department of Energy (DOE) facility located in rural northern Jefferson County, Colorado, which is approximately 16 miles northwest of Denver. It is approximately 6,200 acres in size. The developed portion of the site, referred to as the Industrial Area (IA), is centrally located within RFETS and occupies approximately 400 acres. The Rocky Flats Buffer Zone surrounds the IA and occupies the remaining 5,800 acres. The Original Landfill (OLF) is located in the RFETS Buffer Zone (BZ), south of the Industrial Area (IA; Figure 1). The proposed alternative (for which this wetland mitigation plan was prepared) consists of the removal of surface soil "hot spots" (completed in August 2004), clearing and grubbing of the landfill area, area grading, and implementing the presumptive remedy by placement of a soil cover, cover re-vegetation, monitoring, and institutional controls. Remediation activities will require unavoidable impacts to wetlands within the OLF project area. The wetland mitigation plan outlines the approach and basic plan that will be taken to mitigate for wetland impacts.

Project Information

Location of Project/Ownership

The OLF area located south of the IA at T2S,R70W, Sec. 10 and 15 (Figure 1). The OLF occupies approximately 20 acres.

Responsible Parties

Joseph A. Legare, Director
Project Management Division
Rocky Flats Environmental Technology Site
U.S. Department of Energy
10808 Hwy. 93
Golden, CO 80403-8200
Ph. 303-966-5918

Bob Davis, Project Manager
Kaiser-Hill Company, L.L.C.
10808 Hwy. 93
Golden, CO 80403-8200
Ph. 303-966-7872

Historical Background of OLF

For historical information on the OLF see the *"Draft Interim Measure/Interim Remedial Action for the Original Landfill (including IHSS Group SW-2; IHSS 115 and IHSS 196, Filter Backwash Pond"* document (K-H 2004a) of which this wetland mitigation plan is an Appendix.

Environmental Description of OLF Area

Physiography

The Site is located on the western margin of the Colorado Piedmont section of the Great Plains Physiographic Province at an elevation of approximately 6,000 feet (K-H 1996a). The Colorado Piedmont is characterized as an area of dissected and denuded topography, representing an old erosion surface along the eastern margin of the Rocky Mountains. Several pediments (broad sloping planes formed by coalescing alluvial fans along a mountain front) developed across bedrock in the RFETS area during the Quaternary Period (Scott 1963). The Rocky Flats pediment is the most extensive of these pediments.

The IA is located on a relatively flat surface of the Rocky Flats pediment. The pediment surface has been eroded by Walnut Creek on the north and Woman Creek on the south. As a result, the pediment surface is located at an elevation of 50 feet to 150 feet above the creeks. The grade of the gently eastward-sloping surface of the Rocky Flats pediment ranges from one percent in the IA to approximately two percent just east of the IA. Further east, the pediment's nearly flat-lying surface gives way to lower gently rolling terrain of the High Plains section of the Great Plains Physiographic Province (K-H, 1996a).

Four ephemeral creeks drain the surface water from the Site. The surface water that flows from the northern portion of RFETS is drained by Rock Creek, which is a northeast-trending tributary of Coal Creek. The central and southern portions of the site are drained by Walnut Creek, South Walnut Creek, and Woman Creek. These drainages are all tributaries of Big Dry Creek that flows eastward. Coal Creek separates all of the streams on the Rocky Flats pediment from the Front Range foothills. Surface water flow in these creeks is generally ephemeral; however, some reaches may support intermittent or perennial flow.

Climate

The climate at the Site is characterized as semi-arid (K-H, 1996a) with a mean annual precipitation of approximately 15.5 inches, based on 20-year means for Boulder and Lakewood, Colorado. The wettest season is spring (March through May), which accounts for approximately 40 percent of the annual precipitation, much of which is snow. Thunderstorms during the summer months provide another 30 percent of the annual precipitation. The precipitation gradually declines through the summer, fall and winter (K-H, 1996a). Average annual pan evaporation in central Colorado is approximately 55 inches (DBS 2001).
The predominant wind direction at the Site is northwesterly, and average wind speeds are under 15 miles per hour. Daytime heating causes upslope winds to form, with northeasterly winds common over the broad South Platte River Valley. More localized southeasterly winds

also occasionally occur during the day at the Site because the terrain is oriented southeast toward Standley Lake and the City of Arvada. The winds reverse at night with a shallow westerly drainage wind forming over the site and a broad southerly drainage wind forming over the South Platte River Valley (DOE 1999).

The Site is noted for its strong winds. Gusty winds frequently occur with thunderstorms and the passage of weather fronts. The highest wind speeds occur during the winter as westerly windstorms, known as Chinooks. The windstorm season at the site extends from late November into April, with the height of the season usually occurring in January. The windstorms typically last 8 to 16 hours, with wind speeds exceeding 75 miles per hour in almost every season. Wind gusts exceeding 100 miles per hour are experienced every three to four years (DOE 1999).

Geology

Geologic units beneath the OLF consist of unconsolidated ~~Quaternary deposits~~ that lie unconformably over Cretaceous claystone bedrock. The unconsolidated surface deposits include the Rocky Flats Alluvium that dominates the surface at the Site, colluvial materials that form the slopes of the Woman Creek valley, and valley fill materials on the bottom of Woman Creek valley (EG&Ga, 1995; K-H, 1996a). These materials overlie the Laramie Formation bedrock (Metcalf & Eddy 1995). Geologic units in the OLF area are described below.

Rocky Flats Alluvium

The Rocky Flats Alluvium was deposited by a system of coalescing alluvial fans aggraded by debris flows and braided streams along the base of the Front Range at the mouth of Coal Creek Canyon (EG&G 1995a). The alluvial deposits generally consist of beds and lenses of poorly sorted, clast- and matrix-supported, white to pink, sandy cobbly gravel, gravelly sand, and silty sand (K-H, 1996a). The thickness of this unit ranges from about 3 feet to 30 feet in the areas where the pediment deposits overlie Cretaceous-aged bedrock (K-H, 1996a).

Colluvial Deposits

Colluvial deposits along the valley slopes at the Site are middle Pleistocene to Recent in age (K-H, 1996a). The colluvial material commonly consists of dark-gray to light-reddish-brown, silty sand, sandy silt, clayey silt, and silty clay that contains minor amounts of boulders and cobbles. The unit locally includes clast- and matrix-supported boulders and cobbles, and coarse to fine gravel in a silty-clay matrix. These materials are well graded to poorly graded and unstratified to poorly stratified. Clasts are typically subangular to subrounded, and their sedimentological composition reflects that of the bedrock and surface deposits from which they were derived. The thickness of the colluvial deposits ranges from 3 to 15 feet.

In the OLF area the unconsolidated colluvial deposits consist of sandy, clayey gravel (derived from the adjacent Rocky Flats Alluvium) to sandy clay (Metcalf & Eddy 1995). The colluvium is frequently mixed with fill material in the landfill. Soil borings indicate that the thickness of the colluvium ranges from 1 to 13 feet. The colluvium is damp to moist, although it can be wet near its contact with the Laramie Formation (Metcalf & Eddy 1995).

Valley-fill Alluvium

Valley-fill alluvium, located along the Woman Creek drainage, includes channel and terrace deposits related to the modern stream. These Recent alluvial deposits are commonly grayish-brown, slightly cobbly, silty sand to sandy, clayey silt in the upper part, and poorly sorted, clast supported, slightly cobbly, gravel in a light yellowish brown, clayey, silty sand matrix in the lower part (K-H, 1996a). Clasts are mostly subangular quartzite, with a minor amount of subrounded sandstone derived from older Quaternary deposits. The thickness of these deposits ranges from approximately 3 to 15 feet, with an average of about 10 feet. During geotechnical investigations at the OLF (Metcalf & Eddy 1995), valley fill alluvium was encountered in three boreholes along the toe of the landfill. The alluvium consisted of medium dense to dense, sandy, silty, clayey gravel with cobbles. The alluvium ranged from 5 to 7 feet thick, and groundwater was encountered as shallow as two-feet below ground surface (bgs).

Laramie Formation

Bedrock in the OLF area is Laramie Formation (K-H, 1996a). The Cretaceous-aged Laramie Formation is approximately 600 feet to 800 feet thick. It has been informally divided into upper and lower members (K-H, 1996a). The upper Laramie Formation is generally distinguished from the lower Laramie Formation where the upper Laramie Formation is dominantly composed of fine-grained sedimentary rocks (primarily claystone with no thick sandstone beds). The upper part of the upper Laramie Formation is approximately 300 feet to 500 feet thick, and consists primarily of olive-gray to yellowish orange claystone with large ironstone nodules. A few thin, discontinuous coal seams occur in the upper Laramie Formation. Lenticular beds of platey laminated or friable, calcareous, fine-grained, light olive-gray sandstone occur in the upper Laramie Formation, particularly in the upper portions of the formation.

In the OLF area, the Laramie Formation is a weak claystone formation that underlies the soil-bearing slopes in the area of the OLF (Metcalf & Eddy 1995). It is severely weathered (soft, plastic and moist) in its near-surface aspect and underlies surficial materials in over 50 percent of borings. Moderately weathered Laramie Formation underlies the severely weathered Laramie Formation and is locally plastic, soft, damp, and fractured. It was encountered underlying surficial material in approximately 35 percent of the borings, indicating that the severely eroded Laramie Formation was sometimes displaced through sliding or erosion. Unweathered Laramie is the deepest component of the upper member and is similar to the moderately weathered Laramie Formation, although somewhat drier (Metcalf & Eddy 1995).

Groundwater

The uppermost groundwater is shallow, unconfined groundwater that occurs within the Rocky Flats Alluvium, colluvial deposits, valley fill alluvium, and the weathered Laramie Formation.

This water bearing zone is also referred to as the Uppermost Hydrostratigraphic Unit (UHSU) (EG&G, 1995b). The UHSU is not an "aquifer" because it is not capable of yielding significant and useable quantities of groundwater to wells or springs (EG&G, 1995b). Soil borings in the Rocky Flats alluvium indicate that groundwater appears hydraulically disconnected from the LHSU groundwater. A review of water level change in time reveals that average saturated heights above the weathered bedrock are quite variable. For example, saturated heights range from 0 to 5 feet along Woman Creek; below the bedrock in the east-central waste area; 5 to 10 feet in the central waste area; 0 to 5 feet in the western waste area; and from 10 to more than 40 feet above the bedrock north of the OLF.

UHSU groundwater typically flows towards the nearest stream, or seep area. Flows are strongly affected by unconsolidated material hydraulic properties, and the morphology and orientation of the underlying claystone bedrock and topographic surfaces. Within the OLF waste extent, areas of greater vegetation density typically indicate zones of shallow groundwater or seeps. Groundwater elevations vary seasonally, typically on the order of 5 to 10 feet primarily due to direct precipitation recharge and evapotranspiration. The highest groundwater levels occur in the late winter and spring, and the lowest groundwater levels occur during the late summer and fall. This variability typically causes any seep discharges in the area to be ephemeral.

Surface Water

The OLF is located within the Woman Creek drainage basin, which extends eastward from the base of the foothills near the mouth of Coal Creek Canyon to Standley Lake. The long-term average annual yield generated by this basin is 32.1 acre-feet, with average storms producing surface flows of 4 to 7 cubic feet per second (cfs). During extreme precipitation events (greater than the 15-year return occurrence based on precipitation), surface flows up to 40 cfs have been generated. Although seasonal flows can be low, Woman Creek receives continuous flow from Antelope Springs Creek. The reach of Woman Creek adjacent to the OLF is a gaining reach of stream (groundwater discharges to surface water); however, this inflow is likely due to inflow from the south side of the valley and seepage from the old orchard area (K-H, 1996a).

The Woman Creek drainage basin has an artificial water control structure, the South Interceptor Ditch (SID), which intercepts runoff and routes it to Pond C-2. This runoff would normally flow into Woman Creek or percolate into the underlying subsurface materials of the basin. The Woman Creek diversion dam routes all Woman Creek flows less than the 100-year flood peak around Pond C-2 (K-H, 1996a). With the completion of the Woman Creek Reservoir, located just east of Indiana Street and operated by the city of Westminster, Woman Creek flows are detained in cells of the reservoir until the water quality has been assured by monitoring of Site discharges via Woman Creek Reservoir into the Walnut Creek Drainage below Great Western Reservoir.

In the past, most natural flows in Woman Creek were diverted to Mower Reservoir and did not exit the Site via Woman Creek. This is no longer the case. The Mower Ditch headgates were upgraded, and water in Woman Creek leaves RFETS via Woman Creek (at GS01) and enters the Woman Creek Reservoir. In the past, Pond C-2 (located off-channel in the Woman Creek drainage) was sampled and then pumped to the offsite Broomfield Diversion Ditch. Currently, the Site discharges Pond C-2 directly into Woman Creek via pump (at GS31); the water then flows to the Woman Creek Reservoir.

Ecological Setting

Vegetation

The overall OLF work area crosses several plant community and soil types. The pediment top on the north portion of the OLF project area is composed largely of the Rocky Flats Alluvium. The upper part of the OLF work area is located on this surface. The soil types on this surface are classified as Flatirons very cobbly sandy loam and Nederland very cobbly sandy loam (SCS 1980). The vegetation on this surface is predominantly xeric tallgrass prairie on the western portions of the Site and gradually changes to a needle and threadgrass community as the alluvium thins to the east (K-H 1997). Common species on the xeric tallgrass prairie include big bluestem (*Andropogon gerardii*), little bluestem (*Andropogon scoparius*), mountain muhly (*Muhlenbergia montana*), needle and thread grass (*Stipa comata*), blue grama (*Bouteloua gracilis*), side-oats grama (*Bouteloua curtipendula*), sunsedge (*Carex heliophila*), Canada bluegrass (*Poa compressa*), and a variety of other graminoid and forb species (K-H 1997). The dominance of these species varies from location to location.

The hillside area in the OLF area is dominated by mesic mixed and reclaimed grassland communities. Although native soils on the hillslopes at the Site are classified as Denver-Kutch-Midway clay loams (SCS 1980), much of the OLF area has been reworked and disturbed. Common species on mesic mixed grassland portions of the OLF includes blue grama, side-oats grama, western wheatgrass (*Agropyron smithii*), green needle grass (*Stipa viridula*), Kentucky bluegrass (*Poa pratensis*), Canada bluegrass, Japanese brome (*Bromus japonicus*), and other forbs and graminoids (K-H 1997). However, along much of the SID and other disturbed areas of the OLF hillside the vegetation consists of exotic, reclamation grasses such as smooth brome (*Bromus inermis*), intermediate wheatgrass (*Agropyron intermedium*), and other non-native species. The noxious weeds, diffuse knapweed (*Centaurea diffusa*) and Scotch thistle (*Onopordum acanthium*) are also prevalent, along with several others that are less abundant in the area.

Jurisdiction wetlands in the OLF area are shown in Figure 1. Within the OLF area, the South Interceptor Ditch (SID) has also been designated as a jurisdictional wetland. South of the landfill area, wetland areas are associated with springs and riparian fringe in the Woman Creek drainage. The SID wetland is a narrow, linear ditch, with some cattails (*Typha latifolia*) and coyote willow (*Salix exigua*), and as such has lower functional integrity than natural wetlands associated with Woman Creek (COE 1994). On the hillside above the SID, additional wet areas have developed over the years where outflow pipelines from the IA have exited. At some of these locations, enough moisture has been present at or near the ground surface to support the growth of vegetation characteristic of wetter areas. Coyote willow, plains cottonwood trees (*Populus deltoides*), and arctic rush (*Juncus balticus*) are common in some of these areas. Along Woman Creek, the wetlands are dominated by plains cottonwood,

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coyote willow, false indigo (*Amorpha fruticosa*), snowberry (*Symphoricarpos occidentalis*), arctic rush, and various other plants.

Fauna

Wildlife use in the OLF area is comparable to that documented elsewhere on the grasslands and riparian areas at the Site (K-H 2001). Common wildlife species that could be encountered include small mammals such as deer mice (*Peromyscus maniculatus*), prairie voles (*Microtus ochrogaster*), meadow voles (*Microtus pennsylvanicus*), and house mice (*Mus musculus*), which provide forage for predators like raptors and coyotes (*Canis latrans*). Common raptors at the Site include red-tailed hawks (*Buteo jamaicensis*), Swainson's hawks (*Buteo swainsoni*), great horned owls (*Bubo virginianus*), and kestrels (*Falco sparverius*). Herptiles would be represented by boreal chorus frogs (*Pseudacris triseriatus maculata*), leopard frogs (*Rana pipiens*), and prairie rattlesnakes (*Crotalus viridis*). A variety of songbirds could be found utilizing the grassland and riparian habitats at different times of the year. Western meadowlarks (*Sturnella neglecta*) and vesper sparrows (*Pooecetes gramineus*) are common inhabitants of the grasslands, while Bullock's orioles (*Icterus bullockii*), American goldfinches (*Carduelis tristis*), yellow warblers (*Dendroica petechia*), brown-headed cowbirds (*Molothrus ater*), and other songbirds are common along the streams. Mule deer (*Odocoileus hemionus*) and an occasional white-tailed deer (*Odocoileus virginianus*) also utilize the habitat in and around the OLF work area.

Even though the OLF is a highly disturbed site, the area includes portions of the Preble's Meadow Jumping Mouse (Preble's mouse; *Zapus hudsonius preblei*) protection areas at the Site and wetland areas associated with surface water in the area. The Preble's mouse is listed as threatened by the U.S. Fish and Wildlife Service (USFWS). This listing provides special protection for the species under the Endangered Species Act, and potential remedial actions at the OLF must be evaluated for potential impacts to the Preble' mouse. Preble's mice have been identified in all the major drainages of the Site: Rock Creek, Walnut Creek, and Woman Creek, and the Smart Ditch drainages. The plant communities present in these areas provide a suitable habitat for this small mammal. Preble's mice at the Site are restricted to riparian areas and pond margins, apparently requiring multi-strata vegetation with abundant herbaceous cover. Preble's populations at the Site are found in association with the riparian zone and seep wetlands across the Site. The vegetation communities that provide Preble's habitat include the Great Plains riparian woodland complex, tall upland shrubland, wetlands adjacent to these communities, and some of the upland grasslands surrounding these areas. Recent studies have produced a better understanding of population centers of the species at the Site (K-H 1999, 2000, 2001).

Preble's mice have been captured along Woman Creek in the area of the OLF where a significant amount of suitable habitat occurs. The Preble's mice were captured in riparian areas with well-developed shrub canopies and an understory of grasses and forbs. This is typical of habitats occupied by the subspecies throughout its range (K-H 1996b). The current Preble's protection areas at the Site includes a portion of the OLF area below the SID. The Preble's habitat continues east-west along Woman Creek. Section 7 consultations with the

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U.S. Fish and Wildlife Service are ongoing to address Preble's mouse impacts resulting from the OLF project (K-H 2004b).

Existing Functions and Values

The function and value of the wetlands within the OLF work area provide several functions including water quality enhancement, filtering or trapping of sediment, nutrients, and toxic compounds, ground water recharge and discharge, minor flood conveyance and attenuation, and providing habitat for many plant and animal species at the Site.

Buffers

The areas surrounding the OLF work area and the wetlands within the work area include undeveloped portions of the Buffer Zone and the developed IA. The IA is located to the north of the OLF project area while the Buffer Zone surrounds the project area on the other three sides.

Project Approach

The OLF is being addressed as an accelerated action under the Rocky Flats Cleanup Agreement (RFCA), a combined CERCLA federal facility agreement and RCRA/CHWA Corrective Action Order. Based upon an evaluation of the OLF operation and the waste types and the risks posed by exposure pathways from the OLF, an accelerated action consistent with municipal and military landfill presumptive remedies of source containment after hot spot removal has been determined to be appropriate for the OLF (K-H 2004a). The proposed action is to implement the presumptive remedy of source containment. There are two pathways of exposure to be addressed by source containment:

- direct exposure to disposed waste and commingled soil; and
- surface erosion and runoff of contaminants into surface water.

The components of the source containment remedy that are necessary to address these pathways are:

- a landfill cover to prevent direct contact with landfill soil or debris;
- the landfill cover must also adequately control erosion caused by water run on and run off; and
- institutional controls to supplement the engineering controls to appropriately monitor and maintain the remedy.

In addition to these components, ground water and surface water monitoring will be done to evaluate whether contamination is potentially migrating from the source area and creating a path of exposure through surface water.

The proposed alternative consists of the removal of surface soil "hot spots" (completed in August 2004), clearing and grubbing of the landfill area, area grading, and implementing the presumptive remedy by placement of a soil cover, cover re-vegetation, monitoring, and institutional controls. The surface soil hot spots would be removed prior to all other activities at the site to enhance worker safety.

Control measures would be implemented during this activity to control the spread and release of contamination. The control measures would include the establishment of work zones, decontamination procedures, dust suppression methods, traction mats, visual inspections, and radiological surveys. Work would be suspended when environmental conditions such as during high winds that greatly increase the possibility of the spread of contaminated materials. Monitoring would be performed, as necessary, to verify that there has been no release of contaminated materials.

Excavated areas would be carefully monitored with appropriate field screening devices and laboratory analyses to determine the outer limits of the contaminated surface soil areas. Field screening using standard Site instrumentation would be used to verification the depth and extent of excavation to below the action levels (e.g., NE Electra, micro-R, Ludlum 12, HPGE). Confirmation soil samples would be taken for final isotopic analysis. Following the confirmation samples, non-impacted soils from locations adjacent to the excavated areas would be moved to reduce surface slopes and to blend excavated areas into the surrounding surfaces prior to the action for the entire OLF.

The waste fill areas would be graded to a constant 18 percent (5.5:1) slope angle using a cut and fill approach that is as balanced as possible. Standard earth-moving equipment, such as dozers, hoes or scrapers, would be used to cut the areas where the slope exceeds the desired 18 percent and to fill the areas where the slope is less than the desired 18 percent slope. It is estimated that approximately 70,000 cubic yards of waste fill material would be moved during the process. Control measures would be implemented during the grading process to control the spread and release of waste materials in the OLF. The control measures would include the establishment of work zones, decontamination procedures, dust suppression methods, traction mats, visual inspections, and radiological surveys. Work would be suspended when environmental conditions could greatly increase the possibility of the spread of contaminated materials. Monitoring would be performed, as necessary, to verify that there has been no release of contaminated materials. Erosion controls will be used to control runoff/sedimentation from the project area.

After the grading of the landfill surface is complete, a soil cover will be placed over the landfill to a minimum thickness of 2 feet. About 65,000 cubic yards of local or onsite soil will be used to construct the cover. The soil cover will be compacted sufficiently to provide a stable cover system to promote surface water runoff, reduce surface water ponding, and increase overall slope stability. Revegetation of the soil cover with native species will slow runoff and allow "greater" infiltration. The seeding will be conducted along with erosion control matting or mulch to prevent erosion of the cover while allowing the vegetation to establish a strong stand.

As a result of the remediation actions on the OLF approximately 1.24 acres of jurisdictional wetlands (COE 1994) will be impacted.

Impacted Wetland Area Descriptions

Based on the 1994 U.S. Corps of Engineers wetland report for the Site (COE 1994), approximately 1.24 acres of jurisdictional wetlands may be disturbed by the remediation and construction activities. Table 1 lists the wetland types and acreages that may be impacted. Figure 1 shows the locations of these areas.

Table 1. Wetland Impacts

Wetland Type	Acreage
Palustrine emergent, seasonally and semipermanently flooded	0.61
Palustrine, scrub-shrub, seasonally flooded	0.63
Total	1.24

The SID wetland locations consist of a linear, man-made ditch with some cattails and coyote willow. The wetland impacts along Woman Creek will occur in palustrine emergent and scrub-shrub wetland areas dominated by cattails, arctic rush, snowberry, coyote willow, and some plains cottonwood trees.

Mitigation Approach

A plan to mitigate wetland impacts has been developed to offset the wetland losses resulting from the OLF project. The typical approach to wetland issues is to 1) avoid impacts, 2) minimize impacts that are unavoidable, and 3) mitigate for unavoidable impacts. The OLF project is a required cleanup and remediation action under RFCA. Total avoidance of impacts to the wetlands is not feasible due to the remediation requirements. The wetland losses (1.24 acres) will be mitigated through the use or purchase of wetland banking credits. NOTE: The actual number of acres of wetland disturbed will be mitigated should the actual amount of disturbance be different from that described. If based on the final design of the toe of the landfill slope, it is possible to re-establish the wetlands at that location, the possibility of in-situ wetland re-creation may be evaluated. This would involve contouring the disturbed areas to re-establish the stream channel and then revegetating the area with native wetland/riparian species by seeding, using potted materials, or planting stakes or poles. However, at the present time, the final design of the cover is not available and so it is not possible to evaluate this possibility in any detail.

Mitigation Goals and Objectives

1. Mitigate OLF wetland impacts through the use or purchase of wetland mitigation bank credits (mitigation ratio = 1:1). The total wetland acreage to be mitigated for is estimated to be approximately 1.24 acres.

Rationale for Choice

Given the lack of detailed plans and uncertainty of what will occur along Woman Creek at the bottom of the OLF project area and the permanent loss of wetlands under the OLF cover, the use of wetland mitigation bank credits is the preferred approach.

Mitigation Bank Approach

The first mitigation bank option may use the DOE's Standley Lake wetland mitigation bank for credits to offset wetland impacts in the OLF area. This bank was constructed several years ago by the DOE for use to offset wetland damages at Rocky Flats. At the time of writing, however, the Standley Lake bank had not been certified officially by the EPA although it is expected that this certification will occur soon. If the Standley Lake wetland bank credits cannot be applied to the OLF, then purchase of wetland bank credits from an off-site wetland mitigation bank will be necessary. A mitigation ratio of 1:1 will be used for use or purchase of wetland bank credits from either bank. Two potential commercial wetland mitigation banks that are present along the Front Range of Colorado are listed below.

Potential Off-Site Commercial Wetland Mitigation Banks

Middle South Platte River Wetland Mitigation Bank, Erie, CO
Banker: Land and Water Resources, Inc., 9575 W. Higgins Rd., Suite 470, Rosemont, IL 60018
John Ryan, Ph. 708-878-3903
Mitigation credits were still available as of June 2002. Cost: 60K to 80K+ per acre, variable depending on number of acres purchased.

Mile High Wetland Bank, Brighton, CO
Banker: Mile High Wetland Group, LLC, 80 South 27th Ave., Brighton, CO 80601
Laurie Rink, Ph. 303-659-7002
Mitigation credits are available as of July 2002. Cost: $80,000 per acre, with some decrease for volume purchases.

The wetland acres disturbed (debits) will be tracked in the Site's wetland debit/credit spreadsheet. The use of any wetland mitigation banking credits will also be tracked in the spreadsheet. NOTE: The actual number of acres of wetland disturbed will be mitigated should the actual amount of disturbance be different from that described.

Project Funding

Funding for the project is being provided by the DOE as part of the Site cleanup and closure activities that are being directed and overseen by Kaiser-Hill Company, L.L.C.

References

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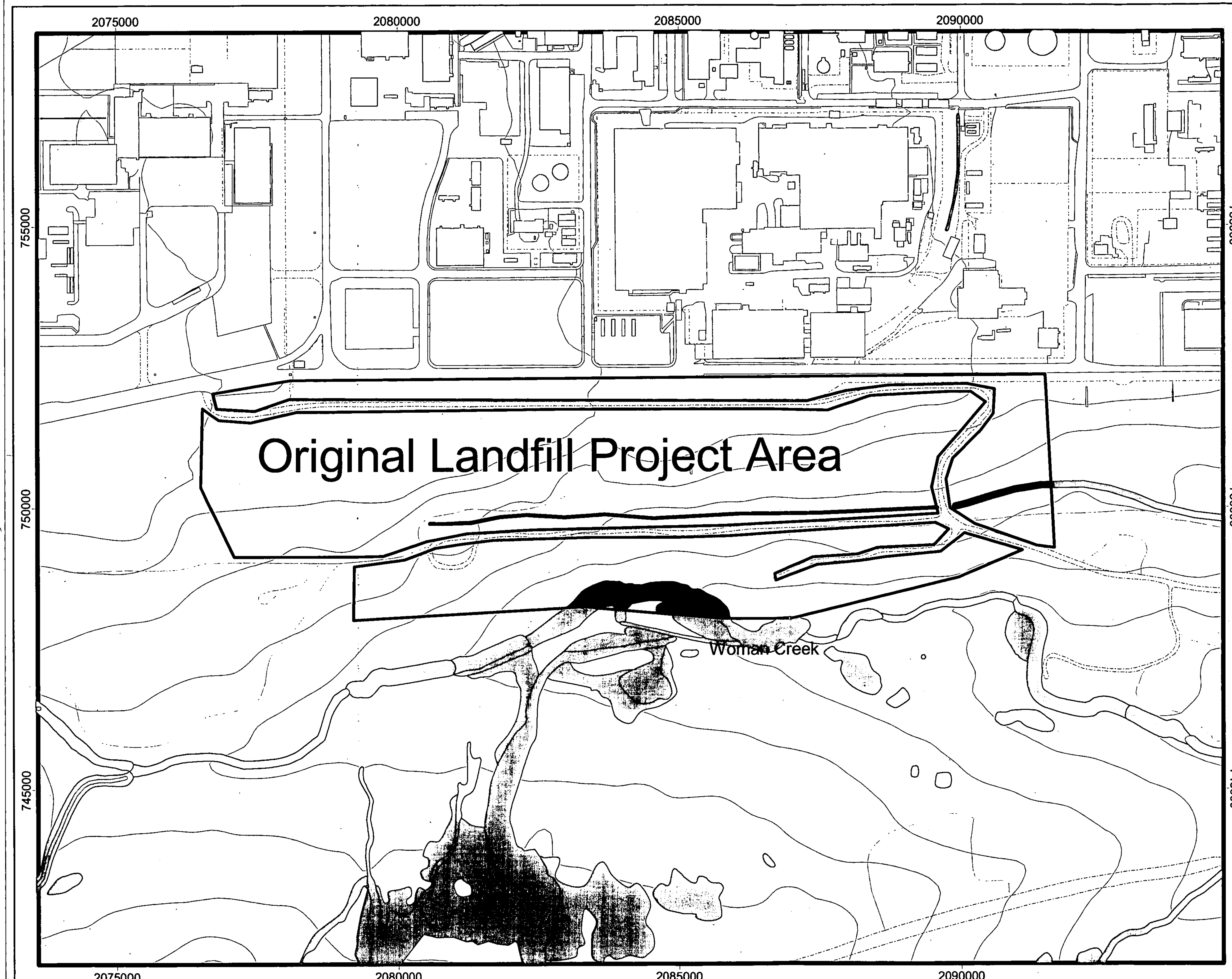
Original Landfill Project Wetland Impacts

Figure 1



Legend

Original Landfill Project Footprint
Jurisdictional Wetlands w/in project footprint COE 1994)
Jurisdictional Wetlands adjacent to project footprint COE 1994)

Standard Features

Buildings
Demolished Buildings
Lakes & ponds
Streams & ditches
Fences
Paved roads
Dirt roads
Contours (20 ft. intervals)

DATA SOURCE BASE FEATURES:
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSL, Las Vegas. Digitized from the orthophotographs, 1/95.

N

100 0 100 200 Feet

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by: Professional Environmental Group, L.L.C.

For: Kaiser-Hill Company, LLC

RFETS GIS Dept.
303-966-7707

MAP ID: 04-0016

October 28, 2004

Q:\Projects\FY2004\04-0016\OLF wetland impacts 04.apr

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Appendix H

Comment Responsiveness Summary

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Colorado Department of Public Health & Environment Comments
Draft Interim Measure/Interim Remedial Action (IM/IRA) for the Original Landfill

	Comment No. (Ref)	Comment	Response
		Executive Summary	
		The groundwater bullet states that, "there are no Tier I action level exceedances for any constituents." The exception is U-238 (see Section 4.5.2).	The Executive Summary will be revised accordingly.
		The next-to-last sentence in the groundwater bullet conflicts with the first sentence in the surface water bullet. Replace "detectable levels" with "surface water standards" to make the next-to-last sentence in the groundwater bullet a true statement.	Agree, the text will be revised.
		Section 2.5 (page 2-6)	
		The annual walkdowns of the landfill surface mentioned in the last paragraph were conducted prior to 2000, but it is our understanding that they were discontinued.	Annual walkdowns have continued from 2000 to 2004.
		The hotspot removals conducted in July 2004 are mentioned elsewhere in this document, but should also be mentioned here to make this section a complete history of previous interim responses.	Agree, the text will be revised.
		Section 3.5.5 (page 3-5)	
		The statement that "the fault is not expected to disrupt the engineering features … and does not appear to impact groundwater hydrogeology" should be supported with evidence or references.	The fault trace on Figure 3-2 is not correctly located. It's bearing is right, but it should have been located near the very western part of the waste material, nearly 600 feet west of where it was shown. If the inferred fault were a significant hydrologic feature, evidence of this would be reflected in several ways. One way would be that groundwater levels near the fault locally decrease along the lineament if it were a more permeable pathway. Conversely, if it were a less permeable feature, or a barrier to flow, groundwater levels would locally build-up behind it and drop off suddenly downgradient. Another indication the fault was a notable hydrologic feature would be an increase in vegetation density along the lineament. Finally, if a fault did exist, and it crosses Woman Creek, there would be clear evidence of localized surface discharge at the intersection of the inferred fault and the creek. To support the integrated flow model of the OLF system, available

			long-term average groundwater level data (Site Water Database) were reviewed and then used to develop a potentiometric surface. Close inspection of this surface shows no obvious indication of the presence of a significant hydrologic conduit, or barrier that may be related to the inferred fault. Review of the potentiometric surface information was summarized for the Site in the SWWB modeling (KH, 2002). In addition, no notable increase in the density of vegetation occurs along the lineament of the inferred fault. The available USGS-mapped seep discharge areas (including inactive seep areas) also show the nearest seep area is more than 600 feet away. Lastly, localized surface discharges occur along Woman Creek in the vicinity of the inferred fault is not evident. Based on these observations, the inferred fault is not believed to be a significant hydrologic feature in the OLF area.
		Section 3.6 (page 3-9)	
		Correct the last sentence of the third paragraph. While the weathered bedrock may be about 20 feet thick, the unweathered bedrock is hundreds of feet thick.	Agreed. The weathered bedrock is generally 20 feet thick in the waste area. This will be corrected.
		Section 3.6 (page 3-10)	
		The quantity of water removed by the drains is important to the model calibration even if the drains are removed in the closure configurations because this flux becomes part of the groundwater flow.	The point of the statements related to this comment were to indicate that closure configuration flows and conditions would not be affected by drain parameters. However, it is acknowledged that drain parameter values will effect model performance under current conditions, and hence calibration. It is likely that increasing drain discharge (i.e., GS22 gage) would help reduce levels in these areas and improve the local calibration (somewhat over-simulated in areas of drains).
		Explain why the wet year climate not also assessed for scenarios 3 and 4.	Since Scenario 2 meets the stability criteria in a wet year condition, wet-year model runs were not required for scenarios 3 and 4. Simulated groundwater levels for Scenarios 3 and 4 within the OLF are always lower than those for Scenario 2.
		Section 4.5.2 (page 4-7)	
		Please revise or remove the "perspective" statement in the last sentence of this section since the background concentration is above health-based levels. Recent data from this well show uranium concentrations as high as 250 pCi/L	The perspective statement was added precisely because background levels are above health-based concentrations. There is no recent data in SWD for well 61093.
		Section 4.6.1 (page 4-9)	

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		It is hard to justify the conclusion in the last sentence of this section given that several average concentrations shown in Tables 4-4a and 4-4b exceed surface water standards. The average values from upgradient surface water stations shown in Table 4-4a yield a U-234:U-238 ratio of greater than 3:1. This ratio indicates the possibility of an upgradient source of depleted uranium affecting surface water in Woman Creek. Since uranium was disposed in an IHSS upgradient to the OLF, this data should be mentioned in this section.	As indicated in the footnote to the table, averages are calculated using only data that exceed background values, i.e, they are not true averages of all the data, and therefore, are biased high. The frequencies of exceeding the ALs are quite low as stated in the text, which is why it is concluded that there are no significant impacts to Woman Creek upgradient of the OLF. As for the uranium isotope ratios, the presence of DU is suspected when U-234/U-238 ratios are less than 1, not greater than 1 as indicated by this comment. At the low uranium concentrations observed, and the use of average concentrations to compute the ratio, it is unlikely that the ratio of 3 is meaningful.
		Section 4.8 (page 4-12)	
		In order to clearly distinguish the hotspot removal action mentioned in the first action determination bullet from other earlier removal actions, the bullet should add that this action took place in July 2004 and removed four areas with elevated uranium concentrations.	Additional text will be added in this section for clarity.
		Figure 4-20	
		The lines connecting the data points on this graph imply a connection or relationship between wells, which is probably not intended.	The line is intended to indicate a trend of decreasing U-235/U-238 ratios with increasing uranium concentrations.
		Section 5.0 (page 5-2)	
		The Regulatory Contact Record mentioned in the fifth paragraph is missing from Appendix C.	The Regulatory Contact Record will be included in Appendix C.
		It is unclear why it is assumed in the sixth paragraph that some subsurface soil may exceed soil ALs for depleted uranium below the hotspots when the confirmation sampling resulted in levels below ALs.	Agreed, this text will be modified to clarify this incorrect presumption.
		Section 5.0 (page 5-3)	
		The hot spot removal action should be listed as the first component of the source containment remedy.	The text will be modified to clarify this point.
		Section 6.2.2 (page 6-13)	
		The preferred alternative is an 18% regrade without a buttress. It appears, however, that this alternative is marginally stable under static conditions, and will be displaced an estimated 5 to 10-inches under seismic conditions. Both static and seismic stability appear to be on the edge of instability. Intuitively, any input changes to reflect more conservative conditions will probably cause the F.S. to	The proposed accelerated action will be changed to Alternative 3, which includes a buttress fill at the toe of the re-graded surface. The buttress fill will provide additional assurance (as shown in the stability calculations by an increased safety factor) for the stability of the OLF cover.

		decrease, thereby dropping the regrade (no buttress) alternative to below the industry acceptable static F.S. of 1.5. As described above, several of the selected inputs used for the modeling appear unconservative, as summarized below: • One of the modeling runs for the 18% regrade only (no buttress) already shows an unacceptable F.S. (1.4) under static conditions. • If the critical section is modeled (Section A from the M&E Report), the groundwater will be higher, reducing the soil strength and subsequently lowering the F.S. • The high groundwater condition modeled in the stability runs were 2-feet above average groundwater conditions. However, the groundwater modeling discusses 5 to 10-feet of fluctuation. • The friction angles selected for static (20°) and seismic (15°) analysis do not bracket all of the samples tested. The lowest friction angle for a material should be used. Detailed comments concerning the stability calculations in the accompanying geotechnical report have been previously submitted. The cumulative effect of those comments is to question whether Alternative 2 could provide the protectiveness described in this section. It appears that the most viable option is to include the additional stability that a buttress would provide and select Alternative 3 as the preferred alternative. The stability calculations must therefore be revised and the text re-written as appropriate.	
		Section 6.2.3 (page 6-15)	
		This presentation of Alternative 3 should be reviewed to see if the text is consistent with recent discussions regarding the design of a buttress fill and drain.	This text will be reviewed and modified to be consistent with recent discussions on this alternative. It will include a brief discussion of the buttress fill and fill drain along with a conceptual buttress cross section.
		Section 7.0 (page7-1)	
		This section must be revised to reflect Alternative 3 as the preferred alternative. Sufficient detail should be provided so that the alternative can be evaluated against the evaluation criteria. The text should mention that design details will be provided in an approved design document.	Agree, the text will be revised.

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		Section 7.4 (page 7-3)	
		This section or Section 10 should commit to the development of a post-closure maintenance and monitoring plan.	Agree, this text will be added.
		Piezometers may provide valuable information in areas where high ground water is predicted.	Piezometers will be considered during the design of the accelerated action to monitor the buttress fill.
		Section 7.5 (page 7-3)	
		Complete sentence in control #3 with "will be prohibited".	Agree, this text will be added.
		Section 8.0	
		An attached table lists additional ARARs that should be included in this section and in Appendix A.	The additional ARARs identified will be included in section 8.0 and in Appendix A except for the Colorado Basic Standards and Methodologies for Surface Water. Groundwater monitoring will be implemented in accordance with the requirements in 6 CCR 1007-3, 265.91.
		Section 9.3 (page 9-3)	
		This section should be more specific about how the regraded cover will "reduce surface water from percolating through the landfill to groundwater."	Agree, additional text will be added to clarify this point.
		Appendix B	
		Since analytical results are not listed in these tables, it would be useful to mentioned where these data can be found, e.g., *Site Characterization Report - Original Landfill* (March 2002).	An electronic file of the data will be added as a part of the final IM/IRA.
		Editorial/typographical comments (minor; changes not required):	
		Section 3.4 (page 3-8)	
		The partial sentence at the beginning of the last paragraph in this section should be deleted.	This sentence will be completed.
		Section 3.6 (page 3-9)	
		The third sentence in the fourth paragraph should state either, "The lack of similarity…" or "The similarity…"	The following statement will be added to provide clarity: "The difference in magnitude of groundwater fluctuations between the two areas suggests that unsaturated and saturated zone hydraulic properties of the waste area may differ somewhat from non-waste areas.".
		Section 3.6 (page 3-10)	
		In the fourth sentence in the sixth paragraph, change "average difference…within the OLF are…" to "average difference…within	Agree, the text will be changed.

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		the OLF is…"	
		The next sentence would be improved by changing it to read, "At some well locations differences are greater that one foot, which can be attributed…"	Agree, the text will be changed.
		Section 3.6	
		Use of units is sometimes inconsistent, e.g., on page 3-11, "feet", "ft." and "meter" are all used.	Text will be modified for consistency.
		Section 4.3 (page 4-3)	
		This section describes a removal action that has already taken place. It is described elsewhere in the document in the past tense and should be in this section also.	Agree, text will be revised for consistency.
		Section 4.5.3 (page 4-7)	
		The bracket in the middle of the first paragraph should be removed (or a close bracket added at the end of the paragraph).	A closing bracket will be added.
		Section 4.5.3 (page 4-8)	
		Well 58693, mentioned in the middle of the Tetrachloroethene paragraph, is not shown on Figure 4-25 along with its accompanying data.	Well 58693 is not shown on Figure 4-25 because the figure presents only recent data (last 3 years). The most recent sample from well 58693 is from May 1993 (16 ug/L of PCE). The well location is shown on Figure 4-3.
		Section 4.6.2 (page 4-9)	
		The second-to-last sentence in the first paragraph is unclear. Two possible meanings are: "Even if these additional detections can be attributed to the OLF, no analyte exceeded its action level more than 7% of the time." Or "Even if these additional detections can be attributed to the OLF, less than 7% of the analytes sampled exceeded the action level."	The correct interpretation is: "Even if these additional detections can be attributed to the OLF, no analyte exceeded its action level more than 7% of the time." Text will be revised to clarify this interpretation.
		Section 4 maps	
		The eastings and northings do not always seem to align between maps of different scales within this set.	Agree, some of the maps will require revision.
		Section 5.0 (page 5-2)	
		Delete the last phrase ("such as for a drinking water.") from the last sentence in the eighth paragraph.	Agree, text will be modified.
		Section 6.2 (page 6-9)	
		The last paragraph should add a reference to Appendix D.	Agree, reference to appendix will be added.
		Section 6.2.2 (page 6-13)	

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		The Geotechnical report should be properly referenced at the end of the second paragraph in the Effectiveness section.	Agree, report will be referenced.
		Section 7.4 (page 7-3)	
		The subject is plural in the second-to-last sentence; the verb should be "are".	Text will be corrected.
		Integrated Flow and VOC Fate and Transport Modeling for the Original Landfill Fill (October 30, 2004)	
	Page 2:	Does this report represent additional calibration performed since the 10/8/04 presentation to the agencies?	Yes it does. Hydraulic properties specified for the colluvium beneath the waste material were set too low and subsequently changed. Calibration and closure scenarios were re-simulated and results included in the draft IM/IRA report.
	Page 3:	Where are the detailed assumptions for the 100-year wet climate scenario?	Details of how the 100-year wet year climate was developed are described in the SWWB modeling report (KH, 2002).
	Page 3:	Please compare each scenario to the calibration case, rather than scenario 1.	While comparison of results from each closure scenario to the current conditions (i.e., calibration model) would be informative, it was decided that the relative change in hydrologic conditions for each closure scenario could be better seen by comparing results of each of these runs to the basecase closure scenario (no OLF modifications). Additionally, the hydrogeologic model will be run during the design of the accelerated action to predict groundwater conditions for the designed grading plan.
	Page 4:	At least one surface seep is controlled by underlying geology. The surface regrade topography may not control the development of seeps in reality as well as it does in the model. The sensitivity and uncertainty in the model need to be assessed before relying on this prediction.	Seeps are produced by a combination of factors that include climate, depth to bedrock, bedrock and topographic surface morphology, hydraulic properties of the soil and groundwater table conditions near these areas. Although the integrated OLF flow model reasonably reproduces flow throughout the OLF hillside area based on a relatively high resolution numerical grid, it is not possible to simulate localized, sub-grid scale seep development. Instead, the model can be expected to simulate development of larger-scale seeps (i.e., over several model cells) under certain conditions due to larger-scale influences (i.e., shallow depth of bedrock). A sensitivity and uncertainty analysis could be performed to further evaluate probability/sensitivity of seep generation, discharge rates and locations.

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	Figure 2-2:	Each model cell on the hillside averages 4 feet of vertical change across a 25-foot cell. Please discuss how this is handled in assessing the calibration.	Simulated groundwater levels are produced at the center of each grid cell (nodes). Simulated levels between cell nodes can be interpolated based on levels calculated at each surrounding node. On Figure 2-2, closure condition groundwater levels shown were interpolated based on node centered cell values to produce a smooth surface. The vertical change across each cell is described response to Figure 3-4 below.
	Figure 2-4:	Non-waste area groundwater depths graph shows well P416889 with a water level depth of about 32 feet, however the total depth of this well is only 23 feet. The other significant decline shown for well P416089 is within the total depth for the well.	Borehole depths for P416889 and P416089 are 23 ft and 39 ft, respectively. Therefore, the two anomalously low groundwater levels as shown on Figure 2-4 are likely outliers and should have been removed from the SWD database. Despite these two anomalies, long-term groundwater levels correlate well with other well water level responses and are believed to be accurate.
	Figure 3-3 Note 3:	Please explain: "Within major distributions soil types further subdivided based on depth to bedrock."	In defining the vertical distribution of soil types within the MIKE SHE code unsaturated zone module, an important change in soil type occurs at the bedrock interface with overlying unconsolidated material. To better simulate the potential buildup of moisture above this contact, if groundwater levels were below this contact, different areal soil type zones were defined in MIKE SHE to reflect this bedrock depth. Therefore, the apparent increase in the number of 'soil types' reflected on Figure 3-3 (i.e., mostly in the OLF hillslope area), simply reflects additional MIKE SHE 'soil types' based on 5-foot bedrock depth intervals within the same unconsolidated surface soil type (i.e., Qrf, Qls, or Qc) specified in the original USGS GIS delineation. In otherwords, in a Qrf area, the bedrock contact in one column may 5 feet, while in an adjacent cell it may be closer to 10 feet. Two different 'soil types' were created to reflect the difference in bedrock depths.
		Please provide the Top of Weathered Bedrock grid and the hydraulic conductivity distributions for each model layer.	This information was not provided in the modeling report to keep graphics and report size to a minimum.
	Figure 3-4:	The legend for this figure printed incorrectly. Please discuss the impact of the physical slope on the calibration and how water levels were interpolated for this diagram.	The legend is incorrect and will be adjusted from meters to feet at the extreme ends of the legend (i..e, >3 and <3 should have read >15 and <-15 feet). As one means of demonstrating model performance, it was assumed that showing differences between node-center simulated levels and observed long-term average levels would be appropriate. As numerous simulations were evaluated, this approach proved easier and more time efficient, but was checked against interpolated simulated levels (i.e., well locations don't occur at model node centers and a more accurate

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			way of estimating simulated levels is to interpolate values using surrounding simulated nodal values). Comparison of nearest simulated node values for a given well against interpolated values from surrounding nodes actually results in better calibration statistics (i.e., RME and RMSE). For example, over the entire model area RME are ~1..03 and 0.97 ft for nodal versus interpolated values, respectively and for RMSE values are about 4 feet. Within the waste area, RME values are ~1.9 ft and ~1.7 ft, respectively for the two methods. These model performance statistics support statements made in the report that the model slightly over-predicts groundwater levels, though this was considered conservative with respect to producing higher groundwater levels/seep production.
	Figure 4-5:	UHSU inflow appears to be negative, however the text seems to indicate this is a positive value and out flow is a slightly larger volume, indicating that a slight amount of water is recharged through this modeled area. Even though inflow and outflow are approximately 1/3 the volume of infiltration and evapotranspiration, the flux through the system is still important to the total volume of water in the system.	The UHSU inflow is positive (i.e., inflow to waste area and beneath it), while outflow is negative (indicating outflow from waste area, or beneath it). The graph can will changed to reflect this.
	Page 31:	Wet climate worst case shows 5-15 feet above the present ground water table, but localized areas where the water table is 20 feet above the weathered bedrock. Was this simulated in the stability calculation?	Results of simulating effects of a wet-year climate over the proposed OLF regrade were shown as saturated heights above the top of the weathered bedrock surface. The reported 5 to 15 feet on page 31 refers to the saturated height above weathered bedrock surface and should not be confused with an actual change in the water table elevation, or depths. In otherwords, Figure 4-8 (maximum annual saturated height above weathered bedrock) should be compared against Figure 4-6 (typical annual saturated height above weathered bedrock). Figure 4-9 was prepared to show the simulated change in water table for Scenario 2 (regrade only) to Scenario 1 (no regrade over OLF, but IA undergoes closure as per assumptions in report). The satbility calculations are addressed in the response to comment, Section 6.2.2 (page 6-13) above.
		The new preferred alternative for the OLF (including a buttress fill with drain) may significantly alter parameters for the fate and transport modeling. If so, the model should be re-run.	Additional runs of the fate and transport model will be considered during the detailed design of the accelerated action.

2 of

Environmental Protection Agency Comments
Draft Interim Measure/Interim Remedial Action (IM/IRA) for the Original Landfill

	Comment No. (Ref)	Comment	Response
		Executive Summary	
		The text of the Executive Summary should be revised to reflect the new proposed alternative.	Agree, text will be modified to reflect Alternative 3 as the proposed accelerated action.
		Section 3.8, Ecological Setting	
		This section should include a basic description of the aquatic habitat, including fish and benthic invertebrate populations associated with Woman Creek, as presented in the "Results of the Aquatic Monitoring Program in Streams at the Rocky Flats Site" (June 2004).	A short description of the aquatic habitat in Woman Creek will be added to the section.
		Section 4.0, Environmental Data Summary	
		This Section should be revised to include comparisons to the Accelerated Action Ecological Screening Levels. This is appropriate because this IM/IRA will effectively be the final action for the Original Landfill.	Accelerated action screens based on ecological receptors are being conducted separate from the IM/IRA. The screens address two land areas relative to the Original Landfill. First, the entire Woman Creek is being screened as an exposure unit (EU) against sediment and surface water ecological receptors. Secondly, the Upper Woman Drainage EU, which includes the Original Landfill, is being screened against surface and subsurface soil ecological receptors. The sediment/surface water assessment will be reviewed with the regulatory agencies in mid-February 2005 and the soil assessments will be completed by mid-March. The IM/IRA is not the final remedy for the OLF. While the proposed source containment accelerated action is consistent with actions that would be required for final closure of the OLF, final closure requirements will be proposed, as appropriate, as part of the preferred alternative in the Proposed Plan for RFETS.
		Section 4.4, Subsurface Soil	
		The discussion regarding subsurface soil does not indicate the depth of borings; it appears that the reported results are for samples composited over 6- to 16-foot intervals. Please clarify how these sampling intervals relate to comparison to Action Levels.	There are over 10,000 subsurface soil analytical records in the database used to evaluate subsurface soil contamination at the OLF. Eighty five percent are for sample intervals less than 6 feet, and approximately half of these are for intervals 2 feet or less. The maximum depth of subsurface sampling is 24 feet; however, two-thirds of the data are for depths of 13 feet or less. These statistics indicate that there are sufficient data at relatively small discrete

			intervals throughout the depth of the fill to characterize the OLF subsurface and conduct an AL comparison.
		The discussion of exceedances to the WRW Action Levels only includes the first component of the Subsurface Soil Risk Screen outlined by the Action Level Framework (ALF). Please present an evaluation of Screens 4 and 5 of the ALF.	The Subsurface Soil Risk Screen is presented in Section 5.0.
		Section 4.9, Risk Assessment	
		The ecological risk assessment is based on a summary from the 1996 RFI/RI report, and no longer current. It should be updated to include data from RADMS verified/validated since 1996, with comparisons to the recently finalized Accelerated Action Ecological Screening Levels (ESLs).	The ecological risk assessment in the 1996 RFI/RI report will not be revised and is present in the IM/IRA as background information. Accelerated action screens based on ecological receptors are being conducted separate from the IM/IRA. The screens address two land areas relative to the Original Landfill. First, the entire Woman Creek is being screened as an exposure unit (EU) against sediment and surface water ecological receptors. Secondly, the Upper Woman Drainage EU, which includes the Original Landfill, is being screened against surface and subsurface soil ecological receptors.
		Section 5.0 Remedial Action Objectives	
		EPA's Presumptive Remedy guidance indicates the need to address leachate as part of the containment remedy. Therefore, the remedial action objectives should address management of landfill leachate (please see comment re: Section 7.0 below). Future sampling of this leachate should include analysis of radiological, VOC, metals, SVOC and pesticide analyte suites.	The groundwater upgradient and downgradient of the OLF will be monitored as presented in the IM/IRA for metals, VOC's and Uranium. EPA's guidance lists five components of the presumptive remedy, one of which is "leachate collection and treatment." The guidance states that "response actions selected for individual sites will include only those components that are necessary, based on site-specific conditions." EPA's study supporting the development of the guidance found that leachate collection was a component of the containment remedy at one-half of the landfills at the NPL sites that were part of the study. The Original Landfill does not produce leachate that will need to be actively managed.
		Because the location of the original landfill is within and immediately adjacent to primary habitat in a National Wildlife Refuge the remedial action objectives should include revegetation of the cover and buttress consistent with goals of the Refuge. The following elements should be included: revegetation of the soil cover and buttress with native species to reduce infiltration, control erosion, burrowing animals, and prevent intrusion of noxious weeds.	The cover and the buttress of OLF accelerated action will be vegetated with native grasses as presented in the IM/IRA, Section 7.0. Revegetation beyond what is described in the IM/IRA, Section 7.0 is not required for the accelerated action or the final closure of the Original Landfill.
		Table 6.1, Summary of Comparative Evaluation.	
		This table should include a line for compliance with ARARs, which is one of the threshold criteria for selection of alternatives. Also, community	A discussion of whether each alternative meets the ARARs is included in the text. An ARARs statement will be added to the table under Protection of

		acceptance is a modifying criteria under the NCP, and usually filled in after public comment is received.	Human Health and Environment.
		Section 7.0	
		The list presented should include a bullet specifying leachate management (sampling with collection and treatment as needed).	The groundwater upgradient and downgradient of the OLF will be monitored as presented in the IM/IRA for metals, VOC's and Uranium. EPA's guidance lists five components of the presumptive remedy, one of which is "leachate collection and treatment." The guidance states that "response actions selected for individual sites will include only those components that are necessary, based on site-specific conditions." EPA's study supporting the development of the guidance found that leachate collection was a component of the containment remedy at one-half of the landfills at the NPL sites that were part of the study. The Original Landfill does not produce leachate that will need to be actively managed.
		Section 7.1, Removal of Surface Soil hot spots	
		The text indicates that "soil with concentrations above the Wildlife Refuge Worker and Ecological Receptor action levels were removed." Ecological receptor action levels have not been developed. Review of Appendix C indicates that the removal was based solely on comparisons to the WRW action levels. Please revise.	The text in the IM/IRA will be revised to remove "ecological receptor action levels."
		Section 7.2, Area grading	
		Please indicate that control measures will be implemented during the grading process to prevent the spread and release of waste materials, not simply "control" such spread.	Additional text will be added to this section regarding the controls during construction of the accelerated action.
		Please indicate that performance monitoring criteria for determining the success of revegetation will be established as part of monitoring requirements in consultation with the RFCA parties.	The revegetation at the OLF is an element of controlling erosion of the soil cover. After final grading of the OLF surface, the area will be re-seeded and mulched, and in some locations matted as described in the RFETS revegetation plan (Revision 2, January 2004). This revegetation plan was followed on the 903 Lip Area where revegetation has progressed successfully. The DOE expects similar revegetation success at the OLF upon completion of the accelerated action.
		Section 7.3, Buttress fill	
		(a) We recommend consideration of a drain design in line with the conceptual drawing provided to DOE on December 9, 2004 and suggest text to reflect that final drain design will be determined during the design phase. The conceptual drain design was intended to facilitate lowering of	Text will be added to clarify that the final drain design will be determined during the design phase. The primary function of the drain is to prevent the build-up of water behind the buttress so that the buttress will not become saturated with water. Design of the buttress fill will incorporate a drain

		the ground water level within the landfill profile. (b) Please add text indicating that the drain will be designed to minimize clogging and maintenance.	designed to minimize clogging and maintenance. A conceptual figure of the buttress fill will be added to Section 7.0.
		Fig. 7.1, Conceptual Buttress Fill Cross Section	
		This conceptual cross section indicates that the 2-foot soil cover will end at the beginning of the buttress fill. We recommend a modification to this concept, wherein the soil cover material extends over the surface of the buttress fill (both horizontal and sloped face) to facilitate revegetation.	This cross section will be modified to indicate soil cover over the buttress.
		Section 7.4, Soil cover	
		Please indicate that both the soil cover and the buttress will be revegetated to reduce infiltration, control erosion, burrowing animals, and prevent intrusion of noxious weeds.	The cover and the buttress of OLF accelerated action will be vegetated with native grasses as presented in the IM/IRA, Section 7.0. The vegetation will help control erosion. Tall grass species will also be planted to deter burrowing animals; however, the OLF does not appear to exhibit any risk to animals in its current condition. Noxious weeds will be controlled through preventive maintenance of the cover.
		Section 9.2, Impacts to surface water	
		This section indicates that post-accelerated action monitoring activities will include inspections of the landfill surface. Please add text to indicate that performance monitoring criteria for the vegetative cover will be established in consultation with the RFCA parties.	The revegetation at the OLF is an element of controlling erosion of the soil cover. After final grading of the OLF surface, the area will be re-seeded and mulched, and in some locations matted as described in the RFETS revegetation plan (Revision 2, January 2004). This revegetation plan was followed on the 903 Lip Area where revegetation has progressed successfully. The DOE expects similar revegetation success at the OLF upon completion of the accelerated action.
		Section 10, Table 10.1	
		Entries in this table indicate that monitoring will be performed for 5 years. Please add a note clarifying that this timeframe corresponds to the regulatory five year review, upon which further monitoring determinations may be made.	Table will be modified to add this clarification.
		This table should be modified to include leachate sampling as indicated above, and include radiological monitoring (Americium and Plutonium) for the surface water sampling locations.	The groundwater upgradient and downgradient of the OLF will be monitored as presented in the IM/IRA for metals, VOC's and Uranium. EPA's guidance lists five components of the presumptive remedy, one of which is "leachate collection and treatment." The guidance states that "response actions selected for individual sites will include only those components that are necessary, based on site-specific conditions." EPA's study supporting the development of the guidance found that leachate collection was a component of the containment remedy at one-half of the landfills at the NPL sites that

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			were part of the study. The Original Landfill does not produce leachate that will need to be actively managed.
		Please indicate that vegetation will be monitored pursuant to specified performance monitoring criteria (to be established as part of monitoring requirements in consultation with the RFCA parties).	The revegetation at the OLF is an element of controlling erosion of the soil cover. After final grading of the OLF surface, the area will be re-seeded and mulched, and in some locations matted as described in the RFETS revegetation plan (Revision 2, January 2004). This revegetation plan was followed on the 903 Lip Area where revegetation has progressed successfully. The DOE expects similar revegetation success at the OLF upon completion of the accelerated action.

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U.S. Fish & Wildlife Service Comments
Draft Interim Measure/Interim Remedial Action (IM/IRA) for the Original Landfill

	Comment No. (Ref)	Comment	Response
		General Comments:	
	1	The Service has always believed that complete removal of the wastes within in the Original Landfill (OLF) is the best alternative in the long-term, because of unknown hazards and stability issues. We do realize that there are other mitigating circumstances that may make certain options less appealing and less implementable, and have, therefore, reviewed the IM/IRA as presented. Throughout the document it is stated that there are only small quantities of hazardous constituents in the OLF, yet in this same document it is stated that accurate and verifiable records of the wastes placed in the landfill are not available. Because of this, the Service recommends a certain level of caution be used in deciding the overall remedy for the OLF.	Consideration of all known data and information on the OLF has been reviewed to select the proposed accelerated action in accordance with RFCA. In considering USFWS's preferred alternative, DOE firmly believes that removing the waste and placing it in another landfill significantly increases the chance of injury to our workers without a significant reduction in risk.
	2	Throughout the document there is reference to the OU-5 Phase 1 RFI/RI. The Service understands that the document was never finalized and approved by the regulators. If so, the reference should include the word "Draft" and it should not be referenced as a final decision document in this report.	The understanding is that the OU-5 Phase 1 RFI/RI was submitted to the regulatory agencies as a final but never approved. The reference will be edited as a final draft.
	3	The Service understands that the preferred alternative now includes a buttress and a drain. We fully support the use of a buttress for additional stability of the landfill slope. The Service believes that the drain should span the entire length of the fill and buttress and should empty out of a distinct, down-gradient point discharge. In this manner, the groundwater that flows through the OLF can be monitored directly. By designing the drain to discharge in multiple places (i.e. avoiding the creation of a point discharge), discharge emanating from the OLF will not be monitored until it has been diluted and is mixed with surface water between ¼ and ½ -mile downstream. If the purpose of the monitoring program is to detect potential contaminants problems at the earliest possible stage, it would be more prudent to monitor this groundwater/leachate before it is discharged to the environment. Given the current design, there would be no simple way to detect if there is a surface water quality exceedance emanating from the OLF.	A drain under the OLF buttress will be designed to prevent the build-up of water behind the drain. The drain will be designed to maintain groundwater flow conditions across the landfill as close as practicable to the current condition A point source discharge would not allow the groundwater flow to resemble the current conditions. Groundwater immediately downgradient of the OLF will be monitored to provide data to evaluate any potential impact to Woman creek before the groundwater would flow into the surface water. The Original Landfill does not produce leachate that will need to be actively managed.

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	4	Appendix B is not a complete Environmental Data Table since there are no analytical results presented; only sampling summaries. Along with the location, sample number, sample date, sample depth, and analyte group, analytical results should be presented as well.	A complete environmental data file (electronic media) used in the IM/IRA is available and will be included in the final IM/IRA.
		Specific Comments:	
	1	Executive Summary, page x, all of the bullets – A reference to where the analytical data is located would be helpful.	A reference will be added.
	2	Executive Summary, page xii, second bullet – Add that a successful and robust stand of native vegetation is also essential for erosion control.	Soil erosion predictions will be calculated during the final design of the accelerated action. Vegetation is an important component for the control of erosion, but other controls may also be applied to the action that are equally important.
	3	Section 1.0, page 1-1, paragraph 2 – Once again, there is a different number for the acreage of Rocky Flats Environmental Technology Site (RFETS), even from the Draft Groundwater IM/IRA. Please check this inconsistency and make certain the correct acreage is used.	This will be checked and corrected.
	4	Section 1.1, page 1-4, paragraph 2 – Does the DOE/KH know how much soil was put on top of the wastes in 1968, and therefore, would DOE/KH know how much soil has eroded, exposing the wastes and debris that is visible today?	The quantity of soil placed on top of the OLF when the operation of the landfill stopped is not known.
	5	Section 1.2, page 1-5, paragraph 2 – The Service understands the desire to make the connection between military landfills and the original landfill with the ultimate goal of using a municipal landfill presumptive remedy. However, how many landfills (not on DOD facilities, but on the NPL) have used the directives as a basis for the presumptive remedy? The Service thinks that DOE/KH should avoid the military landfill guidance and show that the landfill is equivalent to a municipal landfill directly. We think this section is confusing to most readers and needs further explanation, if it were to remain in the document.	The source containment Presumptive Remedy Directives for Municipal Landfills and for Military Landfills is discussed in section 1.2 of the IM/IRA. The Military Landfill source containment directive recognizes that such landfills may contain types of wastes and quantities of these types, such as construction debris and industrial wastes not found in typical municipal landfills. Note that the IM/IRA evaluates the presumptive source containment remedy as one possibly viable alternative. The Military Landfill Directive is primarily used because it is pertinent to specific types of landfills similar to the OLF and thus the information and remedy approach discussed in that Directive serves as guidance in performing the evaluation. Other alternatives analyzed and compared to the presumptive remedy are no action and removal of the waste. In addition, the source containment evaluation considered two containment alternatives, soil cover and soil cover with buttress fill.
	6	Section 3.6, page 3-9, first paragraph – The citation to the Danish Hydrological Institute (DHI) needs to be included in the references, and DHI should be defined in the body of the text	A citation will be added.
	7	Section 3.6, page 3-9, paragraph 4 – The third sentence states: "The lack of similarity between fluctuations in the OLF and those adjacent to the OLF suggests that unsaturated and saturated zone hydraulic	Agreed. The statement should read: "The difference in magnitude of groundwater fluctuations between the two areas suggests that unsaturated and saturated zone hydraulic properties of the waste area may differ somewhat

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		properties of the waste area are similar to nonwaste areas." It seems that the sentence contradicts itself in that, lack of similarities suggest similarities. Please clarify the sentence.	from non-waste areas.' This is consistent with the statement made in the modeling report (page 9).
	8	Section 3.6, page 3-10 and 3-11, Scenario 3 and Scenario 4 – Stakeholders have been told that the inclusion of the slurry wall has virtually no impact on the groundwater modeling. However, according to these bullets, the Wet Year (100-year basis) was not modeled for these two scenarios. Would the model still show that there is virtually no impact during the wet years? What affect would modeling the wet year have on the drain flow from up-gradient of the buttress?	A wet-year climate sequence was simulated for Scenario 2 because this produces conservatively high groundwater levels throughout the OLF. Because this met the stability criteria, a wet-year climate was not simulated in Scenario 3 (slurry wall and regrade) or Scenario 4 (slurry wall, clay buttress, drain and regrade). Although a wet-year climate will produce an increase in groundwater discharge to the buttress drain compared to a typical climate condition, the drain will be designed to intercept and transmit this increase. The model will be used to simulate the 'design' conditions and to estimate discharge rates during a wet year climate.
	9	Section 3.6, page 3-11, paragraph 2 - Reference is made to a mature stand of vegetation. The Service assumes this stand of vegetation would be grasses and possibly forbs. Is this true, or is the DOE/KH considering woody plants on the OLF cover?	Yes, the cover will be planted with native grasses. Woody plants will be controlled and not allowed to grow on the cover.
	10	Section 3.6, page 3-11, paragraph 5 – Simulated drain discharge rates are less than 1 gallon per minute. Is this true while modeling the wet year (100-year basis)? Since discharge is so low, why not have a point discharge that can be easily monitored? With the input of water from the south side of the drainage, it would be almost impossible to monitor the landfill using a surface water monitoring location 2000 feet downstream, which is the proposal. After all, the RFCA states that at the completion of cleanup activities, all surface water on-site and all surface and groundwater leaving the site will be of acceptable quality for all uses.	Yes. Groundwater immediately downgradient of the OLF will be monitored to provide data to evaluate any potential impact to Woman creek before the groundwater would flow into the surface water. A drain under the OLF buttress will be designed to prevent the build-up of water behind the drain. The drain will be designed to maintain groundwater flow conditions across the landfill as close as practicable to the current condition. A point source discharge would not allow the groundwater flow to resemble the currnet conditions.
	11	Section 3.7, page 3-13, paragraph 1 – What is the recommendation for water management in the Woman Creek drainage, both Woman Creek and C-2 pond?	This comment is beyond the scope of the IM/IRA.
	12	Section 4.2, page 4-2, paragraph 1 – It is hard to evaluate surface water and sediment data since the locations are not properly located for evaluation of the original landfill. According to Figure 4-4, there are only two surface water sampling points directly adjacent of the landfill, the next sampling point is about 2000 feet down stream of the landfill and is probably highly influenced by input from the south side of the drainage. According to Figure 4-5, only three sediment samples are located in or directly adjacent to the landfill, none of which were in	All available data have been used to characterize surface water and sediment at the OLF. There are three surface water samples in the OLF, and four more stations directly adjacent to the OLF. Two of the five sediment samples are at a location on the SID where surface water quality impacts have been observed, i.e., they are at a location where impacts to sediment will be the most likely.

		Woman Creek.	
	13	Section 4.3, page 4-4, last paragraph – A discussion of other potential PAH sources should be added to this discussion, since the detections above the action levels and above the method detection levels/reporting levels are pretty well bounded by samples that are less than the method detection levels/reporting levels. How do the method detection levels/reporting levels compare to the accelerated action ecological screening evaluation (AAESE) levels?	Figure 4-7 does not indicate that PAH contamination is bounded largely because locations with detections are interspersed with locations where the concentrations are below the MDL/RL. Although MDLs/RLs for PAHs vary to some extent for historical data, they are by and large below ecological screening levels (ESLs). The AAESE assesses MDLs/RLs against ESLs in the risk evaluation process.
	14	Section 4.4, page 4-4 – Figure 4-8 shows that there is a "relatively isolated location", but there are no other samples bounding the extent of the location, it is hard to determine how isolated it is. Is there a possibility that ash from the incinerator was buried in this location?	DOE agrees that the area, although appearing isolated, is not well bounded to the south and southeast. However, it is unlikely this is the location of buried incinerator ash because this ash is characterized by high concentrations of uranium isotopes, lead, and chromium, which are not observed in subsurface soil samples at the OLF.
	15	Section 4.5.3, page 4-7 – Dieldrin is reported in well 10994, which is apparently down-gradient of the original landfill, yet the wells between the landfill and 10994 did not have any detects of dieldrin. This would indicate that the original landfill is not the source.	Section 4.5.3 concludes that the OLF is not the source of the dieldrin in well 10994.
	16	Section 4.6.2, page 4-9 – See comment 12, it is hard to analyze surface water quality at the locations presented.	All available data was used to evaluate impacts to surface water from the OLF. Three of the surface water stations are directly downgradient of the OLF.
	17	Section 4.9, page 4-12 – See General Comment 2. To present this section as a final decision is not correct. This area will be included in the Comprehensive Risk Assessment, which uses the OU 5 RFI/RI as supporting information. Since the Comprehensive Risk Assessment is not complete, it is premature to conclude that the OLF poses no unacceptable risk to ecological receptors.	The IM/IRA is not the final remedy for the OLF. Section 4.9 provides a summary of previously prepared risk assessments for background information. Accelerated action screens based on ecological receptors are being conducted separate from the IM/IRA. The screens address two land areas relative to the Original Landfill. First, the entire Woman Creek is being screened as an exposure unit (EU) against sediment and surface water ecological receptors. Secondly, the Upper Woman Drainage EU, which includes the Original Landfill, is being screened against surface and subsurface soil ecological receptors. The sediment/surface water assessment will be reviewed with the regulatory agencies in mid-February 2005 and the soil assessments will be completed by mid-March. The IM/IRA is not the final remedy for the OLF. While the proposed source containment accelerated action is consistent with a final action, remedy requirements will be developed in the RI/FS and proposed, as appropriate, as part of the preferred alternative in the Proposed Plan for RFETS.
	18	Section 5.0, page 5.1, first two bullets – The Comprehensive Risk Assessment has not been completed for the exposure unit that includes the OLF. The accelerated action ecological screening evaluation has not been completed either. To say that the OLF has low risk or limited	These bullets are based on the results of the OU 5 Phase I RFI/RI, which is discussed in IM/IRA section 4.9. Also see response to previous comment.

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		to not risk to human health and the environment is being pre-decisional.	
	19	Section 5.0, page 5.1, last bullet – See General Comment 4.	General comment 4 does not seem applicable to Section 5.0, page 5.1, last bullet. General comment 1 seems consistent with this comment. See response to General Comment 1.
	20	Section 5.0, page 5-2, second paragraph – Again, this paragraph seems to say that the ecological risk assessment is completed and final, which it is not. Change the language to say that the ecological risks will be assessed in the Comprehensive Risk Assessment.	The last sentence of this paragraph does acknowledge that ecological risks will be evaluated in the ecological screening process and CRA.
	21	Section 6.1.1, page 6-1, institutional controls – Please define short- and long-term protection. Are they 30 years, 100 years, 1000 years, etc?	Institutional controls do not have a defined time period. Note that this comment is in reference to the no-further action, which is not the proposed accelerated action.
	22	Section 6.1.1, page 6-1, site monitoring – The Service has issues with where the proper monitoring should take place. The surface water monitoring station should be located at the eastern edge of the OLF. The water working group is still discussing the proper locations of groundwater wells.	The locations of groundwater and surface water monitoring stations were presented to stakeholders at a meeting on January 11, 2005. Section 10 will become an appendix to the IM/IRA and include both groundwater and surface water monitoring locations. These locations will be incorporated into the IMP and post-accelerated action monitoring plans
	23	Section 6.1.2, page 6-2, area grading and soil cover – It seems that with the amount of waste fill material (55,000 cy) that needs to be moved and the amount of fill (105,000 cy) needed to obtain an 18% slope, that you are moving the equivalent amount of material that it would take to remove the OLF.	Removal of the material from the OLF requires that the material be picked up, placed into trucks and the transported to another location. The movement of the material in the regrading of the slope will be done by earthmoving equipment only. No transportation of the material will be required.
	24	Figure 6.1, Conceptual Surface Grading Plan – Some of the contours do not match the adjacent contours. The grading plan should try to match the existing contours in adjacent hillsides as much as possible. It may be best to include the area east of the landfill up to the existing road to match the contours.	This figure is a conceptualization of the new cover slope. The final design will establish the final grades and will be designed to match the existing contours adjacent to the OLF.
	25	Section 6.1.2, page 6-5, second paragraph – How was a thickness of 2 feet determined? Why not one foot, or three feet, or even four feet? Please describe how this depth was determined. Will there be monitoring to ensure that the minimum soil depth is retained over the long-term?	A 2-foot soil cover is commonly used for municipal landfill covers and is appropriate for the cover at the OLF since the majority of the waste material is construction debris and solid waste (trash). Two feet is the minimum required cover under current Municipal Landfill regulations governing closure of sanitary landfills. We believe this thickness to be sufficient for long-term effectiveness in preventing direct contact with landfill soil and commingled debris.
	26	Section 6.1.2, page 6-5, second paragraph – It is understood that the soil cover will need to be compacted to initially provide a stable cover system, but compaction of the soil may inhibit the ability for native grasses to grow. Other than grasses, are other plant species planned on	Once the sub-grade is established at the OLF, the 2-foot cover will be placed. The current concept is to place the 2-foot cover soils with minimal compaction by the use of low ground pressure equipment and limited travel of soil delivery trucks on the surface of the landfill. No other plant species are planned.

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		being planted?	
	27	Section 6.1.3, page 6.5, last paragraph – See General Comment 3.	See the response to General Comment 3.
	28	Section 6.1.4, page 6.6 – See General Comment 1 and Specific Comment 23.	See the response to General Comment 1 and Specific Comment 23.
	29	Table 6-1, page 6-10 – How was regulatory/community acceptance determined? It seems to the Service that, at least at the community level, Alternative 4 would have high acceptance.	Moderate was selected since the removal option also exhibits greater health and safety risks due to the excavation and transportation of the waste materials over the other options.
	30	Section 6.2.4, page 6-19 – The Service cannot and will not accept responsibility for any post-action maintenance or monitoring for any of the alternatives.	Reference to the USFWS in this section will be removed.
	31	Section 6.2.5, page 6-20 – This section should be revised since the selection of Alternative 3 is now the preferred alternative.	This section will be revised in the final IM/IRA.
	32	Section 7.0, page 7-1 – The Service understands that there is a new Section 7.0, but at the time of this review, we had not received it. We reviewed it as is. We will review the new section as we receive it.	Comment noted.
	33	Section 7.1, page 7-1, removal of surface soil hot spots – The accelerated action ecological screening evaluation was not done for the OLF, so how does DOE/KH know that surface soil with concentrations above the screening evaluation were removed?	Reference to the ecological receptor action levels will be removed from this text. Accelerated action screens based on ecological receptors are being conducted separate from the IM/IRA. The screens address two land areas relative to the Original Landfill. First, the entire Woman Creek is being screened as an exposure unit (EU) against sediment and surface water ecological receptors. Secondly, the Upper Woman Drainage EU, which includes the Original Landfill, is being screened against surface and subsurface soil ecological receptors.
	34	Section 7.2, page 7-1, area grading and soil cover – The Service is unsure why stormwater drainage swales, run-on and run-off controls are needed. Sheet-flow of stormwater is less likely to cause erosion effects on the slopes and the OLF area will not be draining much of the industrial area up-gradient.	Storm water run-on and run-off controls are used to manage the potential for erosion of the soil cover and are considered to be a Best Management Practice as well as an ARAR. Without storm water controls, the potential exists for drainage rills to form that can continue to erode and cut into the cover of the OLF.
	35	Section 7.2, page 7-2, second paragraph – In the design documents, a maximum compaction percentage should be determined that will stabilize the cover yet allow for native grasses to establish. A seed mix should be developed and agreed upon by the Service.	The design of the accelerated action will consider compaction requirements for the fill, cover and buttress fill. The cover and the buttress of OLF accelerated action will be vegetated with native grasses as presented in the IM/IRA, Section 7.0. Revegetation beyond what is described in the IM/IRA, Section 7.0 is not required for the accelerated action or the final closure of the Original Landfill. The grass seed mix will also be documented in the design, and will match the seed mix that is currently presented in the RFETS re-vegetation plan (Revision 2, January 2004).
	36	Section 7.4, page 7-3, site monitoring – Annual walk-down inspections are not enough, and more frequent walk-downs of the area should be	The text will be revised to include quarterly inspections.

		conducted, particularly in the beginning, to check for erosion.	
	37	Section 7.5, page 7-3, institutional controls, number 3 – Add "will be prohibited" to the end of the phrase.	This text will be added.
	38	Section 8.1.1, page 8-2, first bullet – Change "several feet" to "a minimum of two feet".	"Several feet" is a reference to the sub-grade fill that will be added to the re-graded surface to reach sub-grade elevations.
	39	Section 9.2, page 9-2, first paragraph – Erosion controls should be in place before construction begins. Due to the habitat in the stream area, the Service will be inspecting the erosion controls periodically.	Erosion controls will be implemented during construction of the accelerated action. The text will be modified to clarify the use of erosion controls during construction.
	40	Section 9.2, page 9-2, third bullet – Providing temporary, engineered erosion controls and cover revegetation will not prevent soil erosion, but will reduce/slow erosion.	The text will be modified to clarify this point.
	41	Section 9.4, page 9-3, first paragraph – Preble's Meadow Jumping Mouse should be *Zapus hudsonius preblei*. There should be success criteria developed for the native vegetation that will be seeded after regrading and covering the landfill.	The scientific name of the Preble's Jumping mouse will be added to the text. The revegetation at the OLF is an element of controlling erosion of the soil cover. After final grading of the OLF surface, the area will be re-seeded and mulched, and in some locations matted as described in the RFETS revegetation plan (Revision 2, January 2004). This revegetation plan was followed on the 903 Lip Area where revegetation has progressed successfully. The DOE expects similar revegetation success at the OLF upon completion of the accelerated action.
	42	Section 9.4, page 9-4, last paragraph – The Service should be consulted on wetland mitigation, however, it is the U.S. EPA that will review and approve any issues related to the wetland mitigation.	Comment noted.
	43	Section 9.11, page 9-7, next to last bullet – Due to this statement, the second part of specific comment 41 must be included in the design.	See response to Specific Comment No. 41. The grass seed mix will be documented in the design, and will match the seed mix that is currently presented in the RFETS re-vegetation plan (Revision 2, January 2004).
	44	Section 10.0, page 10-1 – Monitoring requirements must be agreed upon by the regulators and the general community. Additional work is needed on the groundwater and surface water requirements. Erosion monitoring inspections and maintenance needs to be spelled out.	This section will be revised to include additional detail and will be included in the IM/IRA as an appendix.
	45	Table 10.1 – Frequency of visual inspections and sampling should not be just for five years. It should be re-evaluated at five years, but should continue, with appropriate frequency, until there are no longer wastes in the landfill.	Table will be revised to indicate a 5-year re-evaluation period.

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	Rocky Flats Citizens Advisory Board **Draft Interim Measure/Interim Remedial Action (IM/IRA) for the Original Landfill**	
	Comment	**Response**
I	The Board agrees with the proposal to grade the landfill and install a two-foot soil cover over the site of the Original Landfill; however, the Board is concerned about stability at the landfill. Maps from the U.S. Geological Survey show the landfill is in an area of geological instability and is prone to landslides. Over time, the cover could slump and slide and, thus, potentially expose the wastes to humans and the environment. Exposing the wastes would contradict the Remedial Action Objectives (RAOs) to prevent direct contact with landfill soil and commingled waste. The Board believes the addition of a toe buttress, as outlined in Alternative No. 3, would help stabilize the landfill cover. In addition, to prevent groundwater from destroying the integrity of the buttress, the Board believes a drainage system must be installed between the buttress and the cover and underneath the buttress to divert groundwater around the buttress. This would also allow access for monitoring the diverted groundwater.	Alternative No. 3 (re-graded slope with a drained toe buttress) will be the proposed accelerated action in the IM/IRA. The text of the IM/IRA will be modified. Also see response to comment IB below.
A	The Board, therefore, recommends that a modified Alternative No. 3 be chosen rather than the Proposed Alternative No. 2.	Comment acknowledged. The IM/IRA will be modified to show that Alternative 3 is the selected accelerated action for the OLF.
B	Further, the Board recommends that Alternative No. 3 be modified by the addition of a drainage system to maintain the integrity of the buttress. Both the cover and the buttress should be designed using appropriate engineering practices. The drainage system should be L-shaped, and begin at the point located between the cover and the buttress, with the bottom part of the "L" leading under the buttress so as to move groundwater downslope and away from the buttress and the landfill.	Text addressing the buttress drain will be added to the description of Alternative No. 3 for clarity. However, the shape of the drain system does not have an impact on the behavior of the drain. The drain is to prevent the buildup of groundwater from behind the buttress fill, and this can be accomplished with a number of common designs. The IM/IRA will include a conceptual cross section of the buttress fill including the drain.
II	While the document refers to stewardship activities to monitor both the ground water and surface water, there are no details contained in the IM/IRA on these water monitoring networks. Further, at meetings of both the Ground Water and Surface Water Integrated Monitoring Plan Working Groups, stakeholders were informed that the monitoring networks would be addressed in the Original Landfill IM/IRA.	The IM/IRA commits the DOE to groundwater and surface water monitoring after the accelerated action construction is complete. The groundwater and surface water sampling locations were being developed with the EPA and CDPHE after the IM/IRA was issued for public comment. The presentation of these locations is not a requirement in the IM/IRA; however, they were provided to the stakeholders as requested

	The document does not indicate monitoring of the landfill will continue past the first five years after remediation of the landfill is complete. The Board is aware that details of the monitoring program beyond five years will depend on conditions found at that time, however, the document should be changed to recognize that monitoring may continue to be necessary after five years.	and they will be included in the final IM/IRA. Section 10 will become an appendix to the IM/IRA and include both groundwater and surface water monitoring locations. The monitoring locations will be incorporated into the IMP and post-accelerated action monitoring plans.
A	The Board recommends that the IM/IRA include a detailed description of the groundwater monitoring network and the surface water monitoring network for the Original Landfill.	The location of the groundwater and surface water monitoring stations will be included in the IM/IRA. Also see response to comment II above.
B	The Board further recommends that it be allowed to comment on the proposal for both monitoring networks before the IM/IRA is made final.	Comment acknowledged.
C	The Board also recommends that the document be changed to recognize that monitoring may continue to be necessary after five years and should recognize that a decision to continue monitoring of the Original Landfill should be made at the time of the five-year review and should be based on conditions of the Original Landfill at that time.	Text addressing the five-year review of the post-accelerated action monitoring will be added to the IM/IRA.
III	The Board is concerned with the health and safety of workers who will assist in remediating the Original Landfill because they may potentially be exposed to hazardous constituents during the remediation. However, the IM/IRA is deficient in detailing how workers will be protected during remediation activities. The document should reveal how the Site intends to protect workers while the remediation is taking place.	Health and safety planning for the implementation of the accelerated action will be conducted prior to any construction activities. This planning will be presented in the required construction work control documents that will be followed by all the workers during the performance of the work. All work will be conducted in compliance with RFETS procedures, which protect worker health and safety.
A	The Board recommends that the IM/IRA for the Original Landfill contain language that specifies how workers will be protected during the remediation of the Original Landfill.	Health and safety planning for the implementation of the accelerated action will be conducted prior to any construction activities. This planning will be presented in the required construction work control documents that will be followed by all the workers during the performance of the work. All work will be conducted in compliance with RFETS procedures, which protect worker health and safety.
IV	The Board is concerned that the landfill area be protected from intrusion by humans in order to protect human health, the environment, and monitoring systems. To that end the Board thinks that fencing, signs, and other protocols need to be erected in the landfill area in the same way as proposed for the Present Landfill.	The IM/IRA presents the institutional controls to maintain the integrity of the accelerated action. At this time, a fence is not included; however the types of restrictions that may be placed on these lands, including the OLF, will be determined by DOE, CDPHE, and EPA as part of the process that will lead to the CAD/ROD.
A	The Board recommends that the same protocol established for fencing and signs for the Present Landfill also be used at the Original Landfill.	The IM/IRA presents the institutional controls to maintain the integrity of the accelerated action. At this time, a fence is not included; however the types of restrictions that may be placed on these lands, including the OLF, will be determined by DOE, CDPHE, and EPA as part of the process that will lead to the CAD/ROD.
V	The Board is concerned with the lack of specificity with respect to the borrow areas, from which cover materials will be obtained, and how the	The final design will define the material and execution specifications for the accelerated action. The source of the borrow materials will be

	site will restore and revegetate the areas from which fill is taken.	determined during the construction planning process. If the borrow source is from an off-site private supplier, the revegetation of the borrow pit is addressed by the private supplier once the borrow pit is closed. If the borrow source is from on-site, the revegetation will follow the existing RFETS revegetation plan (Revision 2, January 2004).
A	The Board recommends that the Original Landfill IM/IRA identify the borrow areas from which cover materials will be obtained. For those onsite areas from which materials will be taken, the document should be specific in describing the process of restoration and revegetation. The Board recommends the Site consult with the U.S. Fish and Wildlife Service to ensure revegetation and restoration of disturbed areas are in line with the goals of the refuge.	The final design will define the material and execution specifications for the accelerated action. The source of the borrow materials will be determined during the construction planning process. If the borrow source is from an off-site private supplier, the revegetation of the borrow pit is addressed by the private supplier once the borrow pit is closed. If the borrow source is from on-site, the revegetation will follow the existing RFETS revegetation plan (Revision 2, January 2004).

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Rocky Flats Coalition of Local Governments
Draft Interim Measure/Interim Remedial Action (IM/IRA) for the Original Landfill

	Comment No. (Ref)	Comment	Response
		Stabilization of the OLF	
		As the Coalition has commented numerous times, it remains important that the OLF be stabilized to ensure there is no slippage into Woman Creek. These concerns over the stability of the OLF were based in part on its location on a slope above the Woman Creek drainage. The Coalition understands that while the geotechnical study accompanying the IM/IRA does not include a buttress, both CDPHE and EPA are requesting that a buttress be added at the toe of the OLF. The regulators believe the buttress will add an additional measure of safety to the remedy and enhance public confidence in the remedy design. The Coalition therefore strongly supports the regulators' approach for a cap/buttress remedy and requests this proposal be formally added as part of the preferred alternative in the IM/IRA.	Alternative No. 3 (re-graded slope with a drained toe buttress) will be the selected accelerated action in the IM/IRA. The text of the IM/IRA will be modified.
		Protection of Water Quality (Cap Design)	
		Another strong interest of the Coalition is protection of water quality. As the Board expressed at its January 2005 Board meeting, the Coalition supports the use of a Subtitle D cap with Subtitle C ARARs. However, while the Coalition supports this approach, the details are still lacking. The design of the cap/buttress is not included in the IM/IRA so as the design progresses, the Coalition wants to make sure the Site incorporates design features into the remedy that will be protective of water quality. Although the design documents will not be issued for public comment, the Coalition looks forward to updates by the Site as the design process unfolds.	Comment acknowledged. Updates on the progress of the OLF accelerated action will continue through the ER/D&D meeting and additional OLF specific meetings as necessary.
		The City of Westminster has never supported this position. In addition, the Woman Creek Reservoir Authority is having a technical peer review of the proposed remedy conducted and will be providing comments on the proposal after the review is completed and discussed. The Coalition requests the Site provide Westminster and the Reservoir Authority the opportunity to discuss their position on cap designs with the Site.	Comment acknowledged.
		Long Term Stewardship Planning	
		One of the Coalition's core beliefs is the necessity for comprehensive long-term stewardship (LTS) planning. With closure looming we are again	The IM/IRA commits the DOE to groundwater and surface water monitoring after the accelerated action construction is complete.

		disappointed that the IM/IRA lacks any real clarity of the type and extent of LTS controls that will be used to implement the remedy. Although the IM/IRA includes a LTS section, like most Site remedial action documents it is somewhat generic when it comes to specific LTS plans. More specific details are relegated to future documents or determinations made during project construction. An example citing future documentation capturing LTS requirements may be found in *Section 10.0 Additional Long-Term Stewardship Considerations*, quoted as follows: "...Additionally, these requirements will ultimately be captured (along with post-closure care requirements from other accelerated actions at Rocky Flats) in post-closure regulatory documents, which may include the Final CAD/ROD for Rocky Flats or a post-closure RFCA-type agreement." An example of a determination made during project construction is found in *Section 7.5.7 Institutional Controls*, quoted as follows: "To avoid adverse impacts, roads and trails will not be allowed on the cover or the immediate vicinity of the cover. Signs may be erected that indicate vehicles are prohibited from specific areas and that direct vehicle traffic appropriately. A determination will be made during project construction as to whether signs or barriers will be used as the preferred means of restricting access." Towards this end, we are concerned that the details of the post-closure water quality monitoring program are missing. An effective post-closure water quality monitoring network for the OLF remedy is an important component of the Board's interest in LTS planning. Coalition and local government staff were told by the Site that post-closure groundwater and surface water monitoring locations would be identified in the IM/IRA. However, no specific post-closure water quality monitoring locations are identified in the IM/IRA. This omission needs to be addressed. We have been informed by the Site (via email 1/12/05) that a new section detailing post-closure water quality monitoring locations will be added to the IM/IRA. While we applaud this expected addition to the IM/IRA, we are concerned about the process the Site used to identify these monitoring locations. As we understand it, the proposed post-closure monitoring locations have been selected by the OLF remedy design group. The Coalition believes the post-closure monitoring locations should have been selected by the collaborative	The groundwater and surface water sampling locations were being developed with the EPA and CDPHE after the IM/IRA was issued for public comment. The presentation of these locations is not a requirement in the IM/IRA; however, they were provided to the stakeholders as requested and they will be included in the final IM/IRA. Section 10 will become an appendix to the IM/IRA and include both groundwater and surface water monitoring locations. The monitoring locations will be incorporated into the IMP and post-accelerated action monitoring plans. DOE will continue to work with the stakeholders on the development of a long-term surveillance and monitoring plan.

		Integrated Monitoring Plan (IMP) group instead of the OLF remedy design group. The IMP group has served in an advisory role to the RFCA parties in a productive manner over the years and we believe local government and Coalition interests have been well-represented as part of the IMP group. Thus, the Coalition believes that the IMP group should formally review the proposed OLF monitoring locations. The IMP group would then determine if any modifications need to be made to the proposed monitoring locations and pass on any recommendations to the RFCA parties for their consideration. Again, the Coalition remains concerned that the specific details of LTS implementation are being pushed to future decisions. Detailed LTS implementation needs to be incorporated into the remedial actions at the Site as they are planned and executed. We would encourage the Site to engage the Coalition in the decision process as LTS planning unfolds.	
		Characterization	
		Local government staff expressed concern at the Site's IM/IRA public availability session on January 11, 2005 that actual characterization data of the OLF was not included in the IM/IRA. The IM/IRA only described sample locations and types of analysis performed, not sample results. Subsequently, the Site delivered the actual sample result data to those interested the next day in CD format. We are hopeful this data will provide the necessary background that some local government staff are seeking. However, our review of the sample data is in process and we may have additional issues after further review.	Comment acknowledged.
		Other Issues	
		The Coalition has acted in good faith with the Site as the remedial action for the OLF has been developed over the past few years. We are therefore disappointed that the Site rejected our request for an extension to the public comment period for the IM/IRA. As stated by some Coalition Board and staff members at the public availability session, the Coalition does not believe an additional 13 working days (so the Board can approve the Coalition response at the next Board meeting) for further review will compromise the project's schedule. This very short time period pales in comparison to the lengthy delays by the Site in the issuance of the IM/IRA.	DOE was unable to extend the comment period past 45 days for the Original Landfill IM/IRA because of the schedule demands for the Original Landfill project, and because of this project's potential impact on the overall schedule for the Rocky Flats Closure Project. In order to mitigate the impact of this on those reviewing the document, we extended the comment period for the Groundwater IM/IRA to February 10th, allowing reviewers to focus on the Original Landfill IM/IRA. In addition, we held several informational meetings to provide assistance to reviewers. Finally, we responded to comments received after the formal closing of the comment period, thereby providing a *de facto*

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			extension. As the Closure Project nears completion, it is possible that, in the coming months, we will be similarly unable to extend the comment periods for other regulatory documents. As with the Original Landfill IM/IRA, we will continue to work with the public to ensure, to the best of our ability, that comments on these documents are received and considered.
		Furthermore, the draft IM/IRA that was released on December 6, 2004 was incomplete. As previously mentioned, it did not include post-closure water quality monitoring locations. In addition, we did not receive the detailed ARARs analysis for the proposed remedy cover until December 21, 2004. Although the IM/IRA contains information on relevant and appropriate ARARs in section 8 and Appendix A, it did not include the analysis of why the proposed relevant and appropriate ARARs were chosen. So, with these facts in mind, we question the Site's determination to close the public comment period on January 19, 2005.	The IM/IRA commits the DOE to groundwater and surface water monitoring after the accelerated action construction is complete. The groundwater and surface water sampling locations were being developed with the EPA and CDPHE after the IM/IRA was issued for public comment. The presentation of these locations is not a requirement in the IM/IRA; however, they were provided to the stakeholders as requested and they will be included in the final IM/IRA. Section 10 will become an appendix to the IM/IRA and include both groundwater and surface water monitoring locations. The monitoring locations will be incorporated into the IMP and post-accelerated action monitoring plans. The ARARs analysis was prepared in the summer of 2004 and endorsed by the regulators before the draft of the IM/IRA was completed for public comment. Please also note that the ARARs analysis is not part of the IM/IRA document and was provided as a courtesy to stakeholders who requested it.

City of Broomfield Comments
Draft Interim Measure/Interim Remedial Action (IM/IRA) for the Original Landfill

Comment No. (Ref)	Comment	Response
	Cover Letter	
1	**Groundwater and Surface Water.**	
	Broomfield is concerned the proposed remedy is not designed to provide long-term minimization of migration of liquid through the closed landfill. For example, engineered controls should be constructed upgradient of the Original Landfill (OLF) to prevent groundwater from flowing through the waste and the landfill area. Broomfield is not able to evaluate the engineered design of the groundwater drainage associated with the buttress because it was not included in the document. On January 11, 2005 we received a conceptual map of the buttress and drainage area, but insufficient detail was provided to make an informed decision on the proposed remedy. The document should also include surface water management controls to prevent run-on/run-off to reduce the amount of infiltration into the OLF area and mitigate potential impact to water quality in Woman Creek. The location of the Original Landfall is unique because of the potential for direct impacts from both groundwater and surface water to Woman Creek. The IM/IRA should be revised to include the details of the engineered design and the community should be afforded the opportunity to review the proposed designs. Please refer to Section 6 of the attachment for a detailed list of issues in this category.	As presented in the IM/IRA, the landfill has been inactive for over 35 years and the groundwater has been monitored since 1991. The review of this data and including the most recent groundwater data (2003), clearly indicates that the OLF has not impacted the downgradient groundwater quality. Similarly, the review of the surface water data indicates that the OLF is not impacting the water quality of Woman Creek. Therefore, the long-term minimization of the migration of liquid through the landfill is not an RAO. However, implementation of the proposed accelerated action will eliminate the ponding (current condition) of storm water at the surface and provide for positive run-on and run-off control of storm water. The proposed accelerated action includes run-on and run-off controls as presented in the IM/IRA. These controls will be defined in the final design of the accelerated action. The IM/IRA outlines the basic concepts of the accelerated action that forms the basis of the final design.
2	**Stability of the Landfill.**	
	Broomfield is concerned the Original Landfill may be unstable. In summary, the OLF is located within a landslide area and has a fault that goes through the center of the landfill. With groundwater continually impacting underlying soils and bedrock, the area is prone to slippage and movement. Slippage and movement may uncover waste materials and jeopardize the effectiveness of the cover. We agree a buttress should be placed at the toe of the OLF to stabilize the footprint of the OLF. However, the document did not address the floodplain of Woman Creek in relation to the buttress. Flood water could impair the effectiveness of the buttress and reduce the stability of the engineered control. Please	The stability calculations in the geotechnical report supporting the IM/IRA use existing and new geotechnical data to determine the structural stability of the landfill. With these data, stability calculations are made as the landfill exists today and with the re-grading of the landfill surface and the installation of a buttress fill at the toe of the landfill. The stability of the proposed accelerated action is then determined under static conditions, and very conservatively in wet-year conditions with a major seismic event. The calculations show that the landfill can be designed into a stable structure exceeding the design criteria established by landfill guidance. Erosion of the buttress during flood events on Woman Creek will be considered in the final

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		refer to Section 6 of the attachment for a detailed list of issues in the category.	design process.
	3	**Long-term Stewardship.**	
		Groundwater and surface water issues have always been germane for the City & County of Broomfield. To ensure surface water quality is not impacted, a robust sampling and surveillance plan needs to be in place for the long-term. We ask DOE to work with us to develop a long-term stewardship (LTS) plan to ensure contaminant migration is examined, evaluated, and trended to ensure migration does not impact water quality. Until vegetation has an opportunity to mature, it is imperative physical inspections occur after a major storm to prevent sediment loading into Woman Creek and allow for a quick response to repair eroded areas. In addition, DOE should work with downstream asset holders to evaluate and identify the best locations for groundwater wells and surface water monitoring stations. With the potential for the site to close this year, it is essential to work with us to finalize the details of a sound long-term stewardship plan that evaluates the criteria for each project, site-wide criteria, and the needs of impacted local governments. Please refer to Section 7 of the attachment for a detailed list of issues in the category.	Groundwater, surface water and physical monitoring of the OLF after the implementation of the accelerated action will be conducted by the DOE and is outlined in the IM/IRA. Section 10 will become an appendix to the IM/IRA and include both groundwater and surface water monitoring locations. Monitoring locations will be incorporated into the IMP and post-accelerated action monitoring plans. A post accelerated action maintenance and monitoring plan will be developed as a part of the final design that will specifically define the inspection, monitoring & reporting of the conditions at the landfill after the accelerated action has been constructed. DOE will continue to work with the stakeholders on the development of a long-term surveillance and maintenance plan.
		Specific Comments	
	1.0	**Accelerated Action Alternatives**	
	1.1	Preferred Alternative	
		The Draft Interim Measure/Interim Remedial Action (IM/IRA) for the Original Landfill (OLF) identifies Alternative-2 Soil Cover as the preferred alternative. The City & County of Broomfield has attended two meetings after the document has been released for public review and the preferred alternative has since been modified.	Alternative 3 as presented in the IM/IRA will become the selected accelerated action as a result of discussions with the regulators and community during the public comment period.
	1.1.1	Alternative 2-Soil Cover was proposed as the preferred alternative by DOE based on technical documents, yet the revised proposal will now include a buttress at the toe of the landfill. Broomfield believes the document should be revised to include language identifying the preferred alternative along with the proposed design of the buttress and specifications needed to ensure adequate placement of the buttress.	Alternative 3 as presented in the IM/IRA will become the selected accelerated action as a result of discussions with the regulators and community during the public comment period. The IM/IRA outlines the basic concepts of the accelerated action that forms the basis of the final design. The IM/IRA will not include the design and specifications needed for construction of the accelerated action.
	1.1.2	It is very difficult to evaluate a proposed remedy without a complete	The IM/IRA does include the information on Alternative 3 that allows for the

		document to review. It is disconcerting for us to rely on presentations rather than on a formal document.	comparative evaluation of all the alternatives. The IM/IRA is therefore complete for the selection of the preferred accelerated action.
	1.1.3	Based on the assumptions that alternative 3-Soil Cover With a Buttress Fill is the preferred remedy, we have the following concerns/issues:	[redacted]
		Implementation of the presumptive remedy by placement of a 2-foot soil cover does not meet the infiltration criteria to minimize infiltration of precipitation that would cause migration of liquids that are generated by or come in contact with landfilled hazardous waste. Infiltration will contribute to degradation of groundwater quality and migration of groundwater outside of the footprint of the area.	Infiltration has been occurring during the life of the landfill and since its inactive status in 1968, with no impact to downgradient groundwater or surface water along the OLF. The proposed accelerated action will reduce the infiltration from the existing conditions as presented in the IM/IRA, but is not required based on the environmental data and is not an ARAR.
		The original landfill is within a landslide area and the proposed 18-percent (5.5:1) slope is extremely steep for this area. Subtitle C landfills usually have a 5% slope to ensure the stability of the cover. We at this time do not feel comfortable with the 18% slope based on the location of the area and the proximity to Woman Creek.	The stability calculations in the geotechnical report supporting the IM/IRA use existing and new geotechnical data to determine the structural stability of the landfill. With these data, stability calculations are made as the landfill exists today and with the re-grading of the landfill surface and the installation of a buttress fill at the toe of the landfill. The stability of the proposed accelerated action is then determined under static conditions, and very conservatively in wet-year conditions with a major seismic event. The calculations show that the landfill can be designed into a stable structure exceeding the design criteria established by the landfill guidance. Additionally, a 5% slope is not proposed because to achieve this low slope angle, the existing stream channel of Woman Creek would be covered, requiring re-channelization or large culverts, and disrupting a large section of excellent ecological habitat, both Prebles's Mouse habitat and wetlands.
		Control measures to manage the spread and/or release of waste materials and dust control waters are not identified within the document. Revise the document to include the control measure to ensure cross contamination does not occur. Based on the recent release of contamination from the B771/774 project, we question the application of control measures to prevent a release of contamination into Woman Creek. In addition, the document should also be revised to include the control measures and methods to control precipitation run-off and run-on during and after the completion of the project.	Precipitation run-on and run-off controls and dust controls will be defined during the final design of the accelerated action and incorporated into the planning that is implemented before the construction work begins.
		The plan does not identify the size of area to be remediated at one time, nor does it identify the process in which the cover will be placed.	Breaking the construction into areas is one way to manage control of run-off and dust, and will be considered in the final design and work control

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		Managing the size of the area allows controls that prevent cross contamination and decreases the potential for sediment loading into Woman Creek. Revise the document to identify the specific control measures for the project.	documents.
		The document does not identify the alterations to the South Interceptor Ditch (SID) and the potential long-term and short-term impacts. Provide additional information to describe the flow capacity of the SID. Will the SID have the capacity to contain surface water sheetflowing from the landfill along with Industrial Area sheetflow?	The SID within the boundary of the OLF will be eliminated as a result of the regrading. Surface water from the cover of the OLF will generally be directed to the south and not directed into the SID that remains after the construction of the cover. Based on this cover configuration, the SID east of the OLF will not receive any additional surface water compared to what it receives today.
		The document needs to be revised to describe how dust suppression waters will be managed and/or treated.	The details of dust control and water management will be developed in the final design of the accelerated action and the associated work control documents.
		The document needs to be revised to include hold points and the process to be followed in the event buried waste is discovered.	During the preparation of the sub-grade for the cover, waste will most likely be encountered. Construction debris and other solid waste will not stop the construction; however, in the unlikely event that liquid wastes are found, the final design and construction planning will address the process and procedures to contain liquid wastes found during the sub-grade preparation work. The work control documents will describe the process to be followed when buried waste is uncovered.
		Revise the document to include language that a certified opacity inspector will ensure the project stays at less than 20% opacity.	Fugitive dust will be controlled consistent with the substantive requirements of CAQCC Regulation No. 1, which does not include the use of a certified opacity inspector.
		The document does not discuss the possibility of encountering classified parts or the procedure to follow in the event a part is discovered. Revise the document to include the process that will be implemented in the event a part is discovered.	This comment is not within the scope of the IM/IRA, but encountering classified objects will be addressed and managed by existing RFETS procedures. The work control documents will describe the process to be followed when buried waste is uncovered.
		The source of the borrow material for the cover is not identified. Revise the document to identify the source of the borrow material, soil specifications, and placement criteria for the cover.	The final design will define the material and execution specifications for the accelerated action. The source of the borrow materials will be determined during the construction planning process.
		The document does not identify the borrow area for the source material for the buttress. Revise the document to include the borrow area, soil classification, and specifications for placement of the buttress. To simply state *the soil cover will be compacted sufficiently to provide a stable cover system. ...and provide a suitable soil surface for revegetation*, does	The final design will define the material and execution specifications for the accelerated action. The source of the borrow materials will be determined during the construction planning process.

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		not provide us with assurances the buttress will be effective for the long-term.	
		The document does not identify the floodplain for a 15, 25, 50, or 100-year storm. In the event of each storm, revise the document and include a map of the floodplain for each event and the proximity to the buttress.	The final design will take into consideration the flood events and levels of the Woman Creek drainage. A floodplain analysis will be added to the IM/IRA in Section 9, Environmental Impacts.
		Alternative 3- Soil Cover With Buttress Fill identifies the *possible construction of an upgradient groundwater "cutoff" wall immediately north of the OLF*. The City and County of Broomfield is concerned that a groundwater cutoff such as a slurry wall or other engineered mechanism will not be constructed to prevent upgradient lateral inflow of groundwater into the landfill. The intent of closure of a landfill is not only to prevent infiltration via precipitation from impacting groundwater, but also to minimize groundwater infiltration through the OLF. The City & County of Broomfield does not at this time support a closure remedy for the OLF without the construction of an upgradient cutoff.	As presented in the hydrogeologic modeling supporting report to the IM/IRA, the installation of an upgradient groundwater cut-off wall does not significantly alter the groundwater levels and flows at the OLF. Therefore a slurry wall or groundwater cut-off component to the accelerated action was not proposed.
		The buttress *will be constructed by being placed on top of the weathered bedrock or just beneath the weathered bedrock on top of the unweathered bedrock*. Broomfield prefers the buttress be placed on top of the unweathered bedrock for long-term effectiveness and stability.	The geotechnical design of the buttress will determine the position of the buttress relative to the weathered/unweather bedrock to provide a buttress that will meet the relevant landfill guidance criteria.
	1.2	**Summary of Comparative Evaluation of Potential Remedial Alternatives**	
	1.2.1	Table 6-1 does not evaluate the effectiveness of an upgradient cutoff such as a slurry wall. Revise the document to include the long-term effectiveness of the slurry wall or other engineered control and the impacts to the stability factors.	As presented in the hydrogeologic modeling supporting report to the IM/IRA, the installation of an upgradient groundwater cut-off wall does not significantly alter the groundwater levels and flows at the OLF. Therefore a slurry wall or groundwater cut-off component to the accelerated action was not proposed.
	1.2.2	The cost analysis for Alternative 3 does not include a slurry wall. Revise the document to include a cost analysis and comparative analysis with the slurry wall included in the analysis. If the capitol cost for Alternative-3 is $6,000,000 - $6,900,000 does the additional 900,000 account for the slurry wall?	As presented in the hydrogeologic modeling supporting report to the IM/IRA, the installation of an upgradient groundwater cut-off wall does not significantly alter the groundwater levels and flows at the OLF. Therefore a slurry wall or groundwater cut-off component to the accelerated action was not proposed. The range of costs for Alternative 3 does not include a slurry wall.
	1.3	**Preferred Alternative for Broomfield**	

1.3.1	Based on the geotechnical investigation of the OLF (Metcalf & Eddy 1995), a trending southwest fault from the vicinity of Building 371 goes through the center of the OLF. The City & County of Broomfield is concerned the location of the landfill is in a landslide area and has a fault running directly in the middle of the landfill. We support a cap to ensure minimal impacts to groundwater from precipitation, a buttress at the toe of the OLF to stabilize the area, and an upgradient slurry wall to prevent slippage in the area and minimization of liquids migrating into the OLF.	The inferred fault as show in the draft IM/IRA is not shown in the correct location. The inferred fault is about 600 feet west of the location shown in the IM/IRA and on the western edge of the OLF waste boundary. Also see response to comment 1.2.1.
1.3.2	Once again the City & County of Broomfield believes the risk may be minimal today, but due to the proximity to Woman Creek and the uncertainties associated with this area there is a high potential to impact water quality in Woman Creek in the event of remedy failure.	As presented in the IM/IRA, the landfill has been inactive for over 35 years and the groundwater has been monitored since 1991. The review of this data and including the most recent groundwater data (2003), clearly indicates that the OLF has not impacted the downgradient groundwater quality. Similarly, the review of the surface water data indicates that the OLF is not impacting the water quality of Woman Creek. In addition, the geotechnical evaluation of the proposed accelerated action meets the stability criteria established in relevant landfill guidance.
2.0	**Remedial Action Objectives and Consideration of use of "source containment" based on the presumptive remedy to municipal and military landfills (EPA 1993a, 1996)**	
2.1	The Municipal Landfill Presumptive Remedy "source containment" OSWER Directive No. 9355.0-67FS identifies the characteristics of similar landfills to allow for the use of the directive.	Agree. The OSWER Directive was considered in developing the proposed accelerated action.
2.1.1	Broomfield understands presumptive remedies are preferred technologies for common categories of sites based on historical patterns and historical data. Site specific circumstances dictate whether a presumptive remedy is appropriate at a given site. The City & County of Broomfield questions the application of use of the "containment presumptive remedy" based on the components of *Highlight 1*. Highlight I has a key component of source area groundwater control to contain the plume. Based on the proposal provided at the OLF meeting on January 11, 2005 the plume will not be controlled but allowed to migrate through the OLF, beneath the buttress, an continue draining directly into Woman Creek.	There is no identifiable plume originating from the OLF. While specific contaminated ground water plumes may need to be addressed by accelerated actions, this IM/IRA proposes the source containment remedy to address the situation posed by the potential source, i.e., the wastes at the OLF. Migration of ground water has never been controlled at the OLF and after more than 35 years since use of the OLF ended there is no indication of a particular ground water contamination situation that needs to be addressed in this OLF IM/IRA.
2.1.2	The similarities between a military landfill and the OLF could be argued, however we believe the application is inappropriate because the military landfills do not have plutonium, americium, strontium, or uranium in	As pointed out in the last sentence of this comment, these factors were considered in evaluating the proposed source containment remedy. The presence, proportion, distribution and nature of waste and contaminant

	their groundwater. The presence, proportion, distribution, and nature of waste are fundamental to the application of the containment presumptive remedy for landfills.	constituents were evaluated in selecting the containment presumptive remedy for the OLF.
2.1.3	The presumptive remedy does not include land application areas such as surface impoundments. The OLF did include an impoundment that received blowdown from the water plant.	The Filter Backwash Pond, IHSS 196, has not been an identifiable surface impoundment since at least 1964. Its use in holding backwash was apparently short lived. However, there is no evidence that backwash from the treatment of raw water delivered from Denver Water Board reservoirs to render it fit for use as RFETS potable water presented any risks that would be higher than those associated with the OLF debris type wastes. Thus, source containment is appropriate for the IHSS 196 area since it is within the OLF boundaries.
2.1.4	The guidance identifies sensitive environments that may limit the use of the containment presumptive remedy at military landfills. The presence of high water tables is used as an example that would limit the use of the presumptive remedy. The OLF has high water tables and will not be designed to minimization migration of groundwater plumes into and through the area.	See response to comment 2.1.1 above. Water table elevations were considered in evaluating the OLF remedy alternatives.
2.1.5	We disagree with the following statement within the presumptive remedy: *These types of wastes are specific to military bases but generally are not more hazardous than some waste found in municipal landfills.* Low-level radioactive wastes are identified as a waste type in the presumptive remedy. We disagree with the statement that low-level waste may be as harmless as most wastes within a solid waste (municipal) landfill. Per today's regulatory guidelines, any landfill receiving radioactive waste must have a NRC license.	The particular risk posed is dependent in part on the concentration, physical and chemical form and particular type of any hazardous substance, including radionuclides. Small amounts and low concentrations of radionuclides in waste generally do not pose risks that are more significant than many other types of hazardous substances at similar concentrations and quantities found in military facility landfills for which the source containment remedy is appropriate.
3.0	**Application of Applicable or Relevant and Appropriate Requirements (ARARs)**	
3.1	Based on the lack of documentation and characterization of the OLF, it is difficult to make an assumption that the OLF did not receive a significant amount of hazardous waste, Toxic Substance and Control Act (TSCA) waste, or other constituents that may impact water quality. The proximity of the OLF to Woman Creek is more justification to be diligent with a remedy that has a designed life of the cover and associated engineered controls for the long-term.	As presented in the IM/IRA, the landfill has been inactive for over 35 years and the groundwater has been monitored since 1991. The review of this data and including the most recent groundwater data (2003), clearly indicates that the OLF has not impacted the downgradient groundwater quality. Similarly, the review of the surface water data indicates that the OLF is not impacting the water quality of Woman Creek. In addition, the geotechnical evaluation of the proposed accelerated action meets the stability criteria established in relevant landfill guidance. The materials to be used in construction of the

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			proposed accelerated action are all natural materials that have a very long expected life.
	3.2	Revise the document to include the designed life cover for the proposed remedy. Include the input parameters for the determination of the life of the cover.	Text will be added to clarify that the natural materials of construction for the proposed accelerated action are expected, by their very nature, to have a very long expected life.
	3.3	Broomfield disagrees with the ARAR analysis of 265.310(a) (5), permeability requirements and that they are not relevant and appropriate. Groundwater data for metals, radionuclides, and organic compounds have been detected in groundwater at concentrations above background and the Tier II action levels (ALs). Though the concentrations are not consistent, permeability should be a factor.	Groundwater data showed very low levels of contaminants within the landfill boundary, decreasing concentrations of contaminants over time, and no migration beyond the boundaries of the landfill. Based on the National Contingency Plan, its Preamble, and EPA's guidance on determining relevant and appropriate requirements, when these conditions exist, section 265.310(a)(5) would not be relevant and appropriate in this situation. Please note that the ARARs analysis is not part of the IM/IRA document and was provided as a courtesy to stakeholders who requested it.
	3.4	Broomfield disagrees with the ARAR analysis of 265.310 (a) (1), infiltration requirement and that they are not relevant and appropriate. Groundwater data for metals, radionuclides, and organic compounds have been detected in groundwater at concentrations above background and the Tier II action levels (ALs). Though the concentrations are not consistent, infiltration should be a factor.	Groundwater data show very low levels of contaminants within the landfill boundary, decreasing concentrations of contaminants over time, and no migration beyond the boundaries of the landfill. Based on the National Contingency Plan, its Preamble, and EPA's guidance on determining relevant and appropriate requirements, when these conditions exist, section 265.310(a)(1) would not be relevant and appropriate in this situation. Please note that the ARARs analysis is not part of the IM/IRA document and was provided as a courtesy to stakeholders who requested it.
	3.5	The City and County of Broomfield does not agree with the two identified remedial action objectives (RAOs) identified in the document The two RAOs identified in the IM/IRA only address prevention of direct contact with waste and accommodation of surface water runoff to minimize erosion. The RAOs are clearly deficient in identifying the corrective action objectives for the OLF. The design of the cap should *achieve long-term minimization of migration of liquids through the hazardous waste*. We understand groundwater is not a potential source of drinking water at Rocky Flats, but one of the key goals of RFCA is to protect groundwater that will impact surface water. The proximity of the OLF to Woman Creek and the ability for groundwater to surface in the drainages should be justification to minimize migration.	The RAO's were determined based on the physical conditions and the environmental data at the OLF. Based on this information, the accelerated action should prevent direct contact with exposed waste materials and provide for a structurally stable configuration. The environmental data, show that the infiltration of water through the landfill as it has done since 1950, has not impacted the downgradient groundwater or surface water along the OLF.
	3.6	Without having the opportunity to review the design and associated criteria, we are unable to determine if the cover meets the criteria to	The final design including the geotechnical calculations will define the material and execution specifications for the accelerated action. The level of

		promote drainage and minimize erosion or abrasion and accommodate settling and subsidence. To maintain the integrity of the cover and prevent settling and subsidence, the degree of soil compaction and natural stability of the area is a key factor to ensure the integrity and life cycle of the cover. The document has not justified how the requirement for compaction will be performed and documented. In addition, the OLF is located within is a landslide area, therefore 300.400 (g) (2) (i) has requirements that are not obtained within the proposal.	compaction for the sub-grade fill, buttress fill and soil cover will be defined in the final design to provide a stable structure meeting the stability criteria established by the relevant landfill guidance criteria. The 2-foot soil cover will be placed with minimal compaction to promote the growth of vegetation. In the analysis of potential ARARs, 40 CFR 300.400(g)(2)(i) (comparing the purpose of the requirement to the purpose of the CERCLA action) was used to evaluate whether 265.310(a)(3) (promote drainage and minimize erosion or abrasion of the cover) and 265.310(a)(4) (accommodate settling and subsidence to maintain the cover's integrity) were relevant and appropriate requirements. Because the conditions at the Original Landfill were found to be similar to the situation addressed by these two sections, the sections were determined to be relevant and appropriate. Therefore, the action taken must promote drainage, minimize erosion or abrasion of the cover, and accommodate settling and subsidence.
	3.7	Revise the document to include specific design criteria and specifications. We are concerned the use of Rocky Flats alluvium for the cover and the buttress does not allow standard practices to be obtained to ensure the maximum life of the cover. The soils should be sieved to ensure compaction is obtained to ensure the effectiveness and life span of the cover.	The IM/IRA provides the conceptual basis for the final design. Rocky Flats Alluvium type soil is very stable soil consisting of graded soil particles and rock. Compaction of soil will be obtained through functional specifications. The 2-foot soil cover will be placed with minimal compaction to promote the growth of vegetation.
	3.8	265.310(a) (3) addresses drainage and in accordance with EPA guidance, covers that have a slope of 5% or less are considered acceptable to meet these requirements. Broomfield is concerned with the proposed 18% slope and stability within this area.	The stability calculations in the geotechnical report supporting the IM/IRA use existing and new geotechnical data to determine the structural stability of the landfill. With these data, stability calculations are made as the landfill exists today and with the re-grading of the landfill surface and the installation of a buttress fill at the toe of the landfill. The stability of the proposed accelerated action is then determined under static conditions, and very conservatively in wet-year conditions with a major seismic event. The calculations show that the landfill can be designed into a stable structure exceeding the design criteria established by the landfill guidance.
	4.0	**Groundwater and Surface Water**	
	4.1	Groundwater	
	4.1.1	Broomfield is very concerned the IM/IRA does not discuss the need to provide long-term minimization of migration of liquids through the closed landfill. One of the most important design criteria for a cover is to prevent migration of liquids through and into a landfill.	Infiltration has been occurring during the life of the landfill and since its inactive status in 1968, with no impact to downgradient groundwater or surface water along the OLF. The proposed accelerated action will reduce the infiltration from the existing conditions as presented in the IM/IRA, but is not required based on the environmental data and is not an ARAR.

	4.1.2	Revise the preferred remedy to include engineered controls to prevent the infiltration of groundwater through the OLF.	As previously stated, minimizing infiltration of groundwater is not required to be consistent with the ARAR's or RAO's for the OLF
	4.1.3	Revise the IM/IRA to include a finalized design of the landfill cap and provide the public an opportunity to review and comment on the design.	The IM/IRA presents the concepts of the accelerated action that form the basis of the final design. The final design will be developed as a separate set of documents apart from the IM/IRA consistent with RFCA. The design will be submitted to the regulators for approval.
	4.1.4	During the review of the Present Landfill IM/IRA we were not given an opportunity to review or comment on the final cap design. As of this date we have not been provided a copy of the design. We ask DOE to provide us with the copy of the final design of the Present Landfill and allow us the opportunity to review the final design and specification for the cap for the OLF.	A copy of the final design will provided to the stakeholders upon final approval of the design by the regulatory agencies.
	4.1.5	We are disappointed DOE provided Broomfield with the final proposal for long-term groundwater monitoring on the 11th of January, yet the public comment period for the document started on December 6th.	Comment noted.
	4.1.6	DOE held a public meeting on January 11th to discuss any issues the public may have with their proposal. We were disappointed with the meeting because we were unable to discuss the details of the proposal and groundwater management because the details had yet to be defined.	Comment noted.
	4.1.7	The IM/IRA does not address how the headwaters of the buttress will be dispositioned. At the January 11th meeting, K-H informed us the headwaters would be rerouted around the buttress and allowed to drain into Woman Creek. Before the water is rerouted, the water quality should be known before it is allowed to migrate into the Woman Creek drainage. DOE should be working with impacted asset holders to determine how best to manage the groundwater flowing through the OLF.	Groundwater monitoring wells, as presented at the January 11, 2005 meeting, will be installed to monitor the groundwater downgradient of the buttress fill and before the groundwater reaches Woman Creek.
	4.2	**Surface Water**	
	4.2.1	The document does not clearly define how surface water will be managed on or around the OLF. Revise the document to include the controls to prevent run-on of the OLF and control run-off of the cap.	Precipitation run-on and run-off controls will be defined during the final design of the accelerated action and incorporated into the work control documents that are developed before the construction work begins.
	4.2.2	Broomfield is concerned several metals, radionuclies, and organics were detected with concentrations that exceeded background or surface water ALs for at least 5% of the discussed analytes. The lack of frequency is	This section does not conclude that the OLF is not the source of the elevated concentrations. Rather, it concludes that there is no significant chronic impact on surface water if indeed the OLF is the source of the contamination.

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		not a valid technical basis to determine the OLF is not the source of the elevated concentrations.	
	4.2.3	At the January 11th meeting K-H suggested a berm may be constructed upgradient of the OLF and two drainage ditches would be constructed on the east and west side of the OLF that would capture and divert precipitation. The ditches would then fan-out and allow the surface water to flow onto the surface soil. We understand the proposal, but once again the details of the surface water system should be included within the document. Revise the document to include as a minimum the following: 4.2.3.1 Physical characteristics of the berm (concrete, compacted soils); 4.2.3.2 Flow capacity of the ditches; 4.2.3.3 Design of the surface water ditches and berm; 4.2.3.4 Location of areas where surface water will be released on surface soils; 4.2.3.5 Utilization of rip-rap and maintenance criteria should also be included; 4.2.3.6 Sampling criteria, if any for the diversion system; 4.2.3.7 Vegetation criteria for the diversion system; 4.2.3.8 Contingency in the event burrowing animals impair the system; 4.2.3.9 We are very concerned with an 18% slope and the ability to maintain and repair the proposed system, therefore inspection criteria should be identified in the document; 4.2.3.10 In the event of a major storm event, sheetflow with heavily laden sediments may be transported into Woman Creek and the document should address the sediment loading into Woman Creek and the long-term impacts.	These items are design considerations and will be a part of the final design of the accelerated action. Erosion controls will be designed into the accelerated action to reduce the sediment load into Woman Creek.
	5.0	**Data Compilation and Evaluation**	
	5.1	We would like to thank K-H for providing us with a summary of the analytical data associated with the OLF on the afternoon of January 12th. To evaluate the data and trending effectively, the information should have been provided within the IM/IRA to allow us sufficient time to review the impacts to groundwater, surface water, soils, and air quality.	Comment noted.
	5.2	Clarify the source of strontium-90 in the groundwater wells.	Figure 4-17 indicates that strontium-90 concentrations fluctuate around the background concentration, which indicates the strontium-90 is largely at

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			background levels, i.e., the result of atmospheric fallout from global nuclear weapons testing.
	5.3	Well 61093 has groundwater that exceeded background and the Tier I AL for uranium (U). Analytical data confirms the presence of depleted U. We do not understand how DOE has made a determination that the OLF does not impact groundwater quality.	Section 4.8 does conclude that groundwater is contaminated with depleted uranium at this location. This localized groundwater contamination is most likely associated with the surface soil uranium hot spots, which have been removed. There is no indication this contaminated groundwater extends beyond the OLF area being addressed in the IM/IRA.
	5.4	Methylene chloride is not identified as a contaminant because the seven concentrations above the Tier II AL are isolated occurrences in seven different wells. Did the elevated levels occur at different times and when did they occur? If the methylene chloride is not of concern due to the potential for it to be laboratory contaminant, has blank contamination been confirmed to justify the analytical analysis?	The methylene chloride concentrations that are above the Tier II AL occurred between April 1988 and August 2004. Only in wells 64093 and 63893 did methylene chloride occur above the Tier II AL during the same sampling event (April 1995). Methylene chloride was present in the associated blanks in 4 of the 7 samples. In general, methylene chloride appeared in the blank two-thirds of the time when methylene chloride was detected in a groundwater sample. With this level of blank contamination, methylene chloride should be considered a laboratory contaminate.
	5.5	The City and County is concerned with the analysis of tetrachloroethene (PCE) and the potential for PCE to be a source of contamination in the OLF. Three of the wells within the OLF have concentrations about Tier II AL. Well 62893, which is located sidegradient of the OLF and to the east, has a steadily increasing concentration of PCE. We do not necessarily agree the source of PCE for well 62893 is from the Industrial Area, but could be potentially migrating from the OLF if groundwater is moving south and southeast. Buried waste or areas with subsidence could also be forming a pathway for groundwater to travel to the east.	PCE concentrations in well 58494, due west of well 62893, are less than 1 ug/L. This further supports that well 62893 is sidegradient to the OLF, and the OLF is not the source of the PCE in well 62893.
	5.6	The South Interceptor Ditch (SID) has had the highest *frequency of barium exceeding background in SID surface water at over 50% of all observations*. The OLF also has elevated concentrations of barium - therefore the OLF could be a source of the contaminant. Once again the OLF may be a source of groundwater infiltration to the SID. We disagree with the statement that the OLF does not impact groundwater, nor does the OLF groundwater impact media outside of the footprint of the OLF.	Section 4.8 does conclude that groundwater discharges to the SID as evidenced by the depleted uranium concentrations observed at station SW036. With respect to barium, although above background, only 1 of 81 samples for total barium exceeded the surface water AL in SID surface water. The above background concentrations of barium in SID surface water may arise from groundwater discharge since one-third of the groundwater samples exceeded background for dissolved barium.
	5.7	Depleted uranium exists in surface soils and in groundwater at well 61093. The document states *the depleted uranium contamination at SW036 probably arises from both contaminate runoff and discharge of groundwater to the SID (interflow)*. Once again data reflect impacts from the OLF to both groundwater and surface water. With a potential for groundwater to impact surface water quality, it is imperative to	Section 4.8 clearly states that the source of the DU contamination in groundwater and SID surface water is the OLF hot spot. This has been addressed by removal of the hot spot. With this exception, there have been no other contaminants arising from the OLF that have had a chronic adverse impact on surface water quality.

		minimize the migration of groundwater through the OLF.	
	5.8	Based on the data provided in the IM/IRA and not having the opportunity to evaluate the data for the environmental media associated with the OLF, the technical conclusions are based on assumptions rather than data. We do not agree groundwater has not been negatively impacted nor do we agree groundwater is not negatively impacting the quality of surface water. Uranium-contaminated groundwater probably is contributing to surface water AL exceedances at SW036 o the SID. To imply surface water downgradient of the OLF has not exceeded the ALs at the points-of-compliance (POC) on Woman Creek is misleading. The ALs at the POC have been diluted before the water reaches the POC. The City and County of Broomfield does not support dilution as a treatment option for surface water.	As presented in the IM/IRA, the landfill has been inactive for over 35 years and the groundwater has been monitored since 1991. The review of this data and including the most recent groundwater data (2003), clearly indicates that the OLF has not impacted the downgradient groundwater quality. Similarly, the review of the surface water data indicates that the OLF is not impacting the water quality of Woman Creek. The surface soil uranium hot spot removal addressed the most likely source of the SW-036 elevated uranium concentrations. However, other components of the source containment remedy, which also eliminate this portion of the SID, will also mitigate the possibility of water flow from this area of the OL into the remaining portion of the SID. Groundwater immediately downgradient of the OLF will be monitored to provide data to evaluate any potential impact to Woman creek before the groundwater would flow into the surface water. This accounts for any dilution by surface water flows.
	5.9	Revise the document to include additional information related to the Filter Backwash Pond. If the sludge or sediment was not removed from this pond, provide the characterization of this area. We are concerned the backwash water flowed through the burning pit and may have additional constituents that are not identified within the IM/IRA. The presumptive remedy proposed in the document is not considered appropriate for areas that contain surface impoundments.	There is no additional information on the filter backwash pond. Two boreholes penetrated this IHSS (58493 and 58693), so the subsurface condition at this location has been characterized. In general, all media at the OLF are well characterized.
	6.0	**Stability of the landfill**	
	6.1	The document states: *There is no indication of current landslides or mass movement of the waste and soil fill.* Is this statement based on visual interpretation or actual measurements to determine movement?	Past geotechnical mapping and data coupled with current visual observations do not indicate movement of the soils and placed wastes at the OLF.
	6.2	Revise the document to include supporting documentation and measurements to justify the stability of the area.	The supporting geotechnical report to the IM/IRA provides this information.
	6.3	The geotechnical investigation of the OLF (Metcalf & EDDY 1995) identifies a fault that goes through the center of the landfill. *It is expected the fault is not expected to disrupt the engineering features or impact the structural integrity of the landfill, and does not appear to impact groundwater hydrogeology.* We are concerned the fault may have	Extensive studies at RFETS have shown that the inferred fault at the OLF is not "capable." Movement at this inferred fault is highly unlikely. The fault trace on Figure 3-2 is not correctly located. It's bearing is right, but it should have been located near the very western part of the waste material,

		a fracture that could potentially impact the deep aquifer in this area. The Geotechnical Investigation Phase 3 Report does not address the potential impacts to engineering features in the event of disruption.	nearly 600 feet west of where it was shown. If the inferred fault were a significant hydrologic feature, evidence of this would be reflected in several ways. One way would be that groundwater levels near the fault locally decrease along the lineament if it were a more permeable pathway. Conversely, if it were a less permeable feature, or a barrier to flow, groundwater levels would locally build-up behind it and drop off suddenly downgradient. Another indication the fault was a notable hydrologic feature would be an increase in vegetation density along the lineament. Finally, if a fault did exist, and it crosses Woman Creek, there would be clear evidence of localized surface discharge at the intersection of the inferred fault and the creek. To support the integrated flow model of the OLF system, available long-term average groundwater level data (Soil/Water Database) were reviewed and then used to develop a potentiometric surface. Close inspection of this surface shows no obvious indication of the presence of a significant hydrologic conduit, or barrier that may be related to the inferred fault. Review of the potentiometric surface information was summarized for the Site in the SWWB modeling (KH, 2002). In addition, no notable increase in the density of vegetation occurs along the lineament of the inferred fault. The available USGS-mapped seep discharge areas (including inactive seep areas) also show the nearest seep area is more than 600 feet away. Lastly, localized surface discharges occur along Woman Creek in the vicinity of the inferred fault does not exist. Based on these observations, the inferred fault is not believed to be a significant hydrologic feature in the OLF area.
	6.4	Broomfield is concerned the continued impact of groundwater inflow on the underlying soils and bedrock may contribute to potential sliding in this area. The long-term stability of the OLF can be greatly enhanced by providing an engineered structure upgradient of the OLF to prevent groundwater inflow into the area.	The geotechnical evaluation presented in the supporting report to the IM/IRA considers 100-year wet conditions and clearly shows that the OLF is stable under high groundwater conditions after the proposed accelerated action is implemented.
	6.5	The document states subsidence may occur within the area once the cover is placed. Revise the document to include the basis for the identified amount of subsidence (1-2 feet). Also include the evaluation criteria to determine subsidence and the corrective action to be taken in the event of subsidence.	Subsidence is predicted as a part of the final design of the accelerated action. Subsidence is believed to be very small and a minor concern given that natural soil is placed and compacted for the construction of the landfill cover. Adding soil and re-seeding can easily repair any subsidence.
	6.6	The IM/IRA does not include the design of the buttress or the cover. We are disappointed a complete document was not provided to us for review and provide comments to DOE. The final design of the OLF cover is	The IM/IRA presents the concepts of the accelerated action that form the basis of the final design. The final design will be developed as a separate set of documents apart from the IM/IRA consistent with RFCA.

		critical to ensuring the long-term stability of the OLF.	
	6.7	Tiering of the cover should have been an alternative that was evaluated based on the location of the OLF and the steepness of the area. Tiering has been an effective means of erosion controls in steep areas rather than extending the toe of an identified remedial area. Tiering reduces the velocity of run-off and the weight of the cover at the toe of the cover. Revise the document to include an alternative analysis of tiering.	Tiering (or terracing) is not required to establish a stable landfill configuration at the OLF.
	6.8	The proposed conceptual design provided to us at the January 11th meeting has the buttress tied into the weather bedrock and a buttress drain in the weathered bedrock. To ensure the stability of the OLF and its contents the buttress should be tied into the unweathered bedrock to ensure less slippage and increase stability. Without having a final design of the buttress and cover, we suggest the buttress be tied into the unweathered bedrock to enhance the stability of the OLF area.	The geotechnical design of the buttress will determine the position of the buttress relative to the weathered/unweathered bedrock to provide a buttress that will meet the EPA landfill guidance criteria.
	6.9	The document does not include the specifications for the buttress design. We are concerned Rocky Flats alluvium will be used for the buttress material. Based on the amount and size of rock in the Rocky Flats alluvium it will be impossible to compact the soils to meet specifications and ensure the stability of the buttress and the cover for the long-term.	Construction experience at the Present Landfill has shown that the Rocky Flats Alluvium compacts very well and provides a very stable structure. Compaction will be assured through a functional specification. The 2-foot soil cover will be placed with minimal compaction to promote the growth of vegetation.
	7.0	**Long-term Stewardship**	
	7.1	**Information Management**	
	7.1.1	One of the records identified as being necessary for succeeding generations to understand the nature and extend of the residual contamination in the OLF is the Memorandum of Understanding (MOU) between DOE and the U.S. Department of Interior. The City and County of Broomfield is concerned the MOU has not been signed and we do not understand the potential impacts the MOU may have on our decisions pertaining to the OLF and the proposed remedy.	This comment is beyond the scope of the IM/IRA.
	7.1.2	Broomfield expects to have dependable, easy access to data to evaluate impacts to our community over the long term.	This comment is beyond the scope of the IM/IRA.
	7.1.3	We support the CERCLA 5-year review process. We ask that we be included in the review process such as inspections and review of supporting documents for the 5-year review.	Comment acknowledged.
	7.2	**Monitoring, Maintenance, and Institutional Controls**	
	7.2.1	Revise the document to include visual inspections of the cover after major storm events until vegetation has matured. Quarterly inspections may not be sufficient to ensure adequate vegetation growth, maintenance of erosion mats short-term, and control of erosion areas short-term.	Comment acknowledged. Quarterly inspections are now planned when the construction of the OLF accelerated action is complete; however, DOE will continue to work with the stakeholders on the development of a short-term and long-term surveillance and maintenance plan.

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	7.2.2	Revise the document to include the frequency of inspections will be monthly or after a major storm event until vegetation matures. Once vegetation matures inspections will occur quarterly until the first CERCLA 5-year review. During the review the maintenance and inspection schedule will be reevaluated. Due to the location of the OLF, more frequent inspections may be required during the wet seasons.	Comment acknowledged. Quarterly inspections are now planned when the construction of the OLF accelerated action is complete; however, DOE will continue to work with the stakeholders on the development of a short-term and long-term surveillance and maintenance plan.
	7.2.3	Revise the document to include the corrective action for erosion repair. Include the criteria to determine the need for repair such as size of cracks, swells, etc. If riprap is to be used the specifications for the riprap should also be included.	Rip-rap, if needed, will be specified in the final design of the accelerated action. Erosion repairs will be defined in the OLF maintenance and monitoring plan that will be developed after the final design is complete.
	7.2.4	Revise the document to include the corrective action for subsidence, the specifications for measuring and determining subsidence, and the responsible party for the corrective action.	Repairs of subsidence areas will be defined in the OLF maintenance and monitoring plan that will be developed after the final design is complete.
	7.2.5	Revise the document to include the process and specifications for removing deep rooting trees or for weed control measures. Due to the proximity of Woman Creek, it is best not to use herbicides that may impact water quality.	Tree and weed control will be defined in the OLF maintenance and monitoring plan that will be developed after the final design is complete.
	7.2.6	Revise the document to include the specifications and corrective actions for burrowing animals. How will the animals be removed and what is the timeframe to repair the damaged cover. On a tour of the landfill on January 14th, downgradient of the OLF, there were signs of burrowing animals in the area.	Active management of burrowing animals is planned for the RFETS Site including the OLF and will be part of a site-wide maintenance plan.
	7.2.7	Revise the document to include the same above mentioned issues for the perimeter ditches.	The monitoring and repair of the perimeter ditches or swales will be defined in the OLF maintenance and monitoring plan that will be developed after the final design is complete.
	7.2.8	We do not agree with the proposed surface water monitoring in Table 10.1. Flow and field measurements should be included in the table. We ask DOE to work with the City and County of Broomfield and other impacted local governments to identify the surface water sampling criteria for the OLF through the Integrated Monitoring Process (IMP). Once again we are disappointed we were not given the opportunity to work as a team with DOE to develop the long-term surface water monitoring criteria for the OLF. We ask that in accordance with RFCA that IMP process and the Water Working Group be utilized to finalize the long-term stewardship surface water monitoring criteria.	Flow measurements will be a part of the surface water measurements at the surface water monitoring stations. The selection of the OLF monitoring locations has involved members of the Water working Group.
	7.2.9	The locations of points of measurements (POMs) need to be included in the document. Action levels at the POMs need to be identified along	Surface water and groundwater monitoring locations will be included in the IM/IRA. Action levels are also discussed in the IM/IRA.

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		with corrective actions in the IM/IRA.	
	7.2.10	We do not agree with the proposed 2 POMs that were discussed at the January 11th meeting. Further discussion is needed to determine the adequate siting of the POMs.	Comment noted.
	7.2.11	We do not agree with the proposed groundwater wells for the OLF. We are concerned about the location of the upgradient groundwater well and believe an additional well should be located northwest of the OLF for a more adequate evaluation.	The one upgradient well, based on all the hydrogeological information on the RFETS site, is sufficient to determine the upgradient groundwater quality for the OLF.
	7.2.12	We are concerned the two of the three downgradient wells are too close to Woman Creek because they do not provide sufficient time to mitigate plume migration. The purpose of the remedy is to contain the contamination and prevent degradation of water quality in Woman Creek. We understand the document states groundwater from the OLF does not impact groundwater outside of the footprint of the OLF significantly, however we are still unconvinced U, metals, and VOCs are not impacting groundwater quality downgradient of the OLF.	As presented in the IM/IRA, the landfill has been inactive for over 35 years and the groundwater has been monitored since 1991. The review of this data and including the most recent groundwater data (2003), clearly indicates that the OLF has not impacted the downgradient groundwater quality. Similarly, the review of the surface water data indicates that the OLF is not impacting the water quality of Woman Creek. Section 10 of the IM/IRA will become an appendix and include both groundwater and surface water monitoring locations. Monitoring locations will be incorporated into the IMP and post-accelerated action monitoring plans. The final locations of these downgradient wells will be determined in the final design. The location of the wells will be a close as practicable to the OLF boundary.
	7.2.13	We once again ask DOE to work with us to develop long-term groundwater monitoring criteria for the OLF. We ask that in accordance with RFCA that the IMP process and the Water Working Group be utilized to finalize the long-term stewardship groundwater monitoring criteria.	Comment acknowledged.
	7.2.14	We ask to be involved in the process to identify institutional and physical controls of the OLF. Once again without a signed MOU, it is difficult to evaluate the proposed institutional controls and physical controls without knowing DOE's and DOI's areas of responsibility.	This comment is beyond the scope of the IM/IRA. However, the OLF will be retained by the DOE regardless of the MOU.
	7.2.15	The City and County of Broomfield prefers a fence be erected around DOE retained lands including the OLF to prevent public access to protect the remedy and monitoring stations.	Comment acknowledged.
	7.2.16	Annual reporting of the data results associated with the OLF is unacceptable short-term. Quarterly data associated with the OLF should be provided at the Data Quarterly Data Exchanges. Legacy Management has already committed to working with asset holders for the short-term to exchange data. The City and County will continue to host the Data Quarterly Exchange meetings and team with other downstream	Comment acknowledged. DOE will continue to work with the stakeholders on the development of a long-term surveillance and maintenance plan.

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		governments to provide data information to our communities.	
	7.2.17	Any elevated concentrations or exceedances of ALs should be reported as per the current criteria. Downstream impacted governments should be notified the same time the regulators are notified	Comment acknowledged.
	8.0	**Wetland Mitigation**	
	8.1	It is impossible to evaluate the wetland mitigation approach. We are not certain the wetland mitigation will be on-site at the toe of the OLF or off-site. Without knowing the contouring of the final design, we cannot comment on the approach.	Until the final design is ready the actual impacts to the wetlands cannot be determined. The final locations of the buttress fill will determine whether wetlands can be re-established or not.
	8.2	We are concerned with the mitigation ratio of 1:1. Wetlands are very sensitive and mitigation success is very difficult. Revise the document to include additional information for the proposed banking areas off-site. Clarify the cost differences between acre prices of the potential commercial wetland mitigation banks.	Comment noted. The plan contains the location and contact information for each of the potential wetland mitigation banks. Detailed information on each bank is beyond the scope of this document, as the banks are only mentioned as potential options.
	8.3	Previously EPA did not approve of either of the proposed banking areas due to the distance from Rocky Flats. Revise the document to include both EPA's and the Fish and Wildlife's approval of the proposed designated areas.	If an off-site wetland bank is used the first choice would be Standley Lake if credits are available. Other off-site banking approaches would be discussed and approved by the EPA. The USFWS does not approve the use of wetlands mitigation credits from wetland banks.
	9.0	**Supporting Documents**	
	9.1	The VOC Fate Transport document was very general and based several decisions on assumptions. We understand the document is based on the site-wide VOC Fate Transport document and that the Groundwater IM/IRA supports both documents. We at this point in time cannot effectively evaluate DOE's proposals due to the time constraints to review all supporting documents.	Comment Noted.
	9.2	The geotechnical evaluation was very detailed and once again we were not allocated sufficient time to adequately review the document and provide meaningful comments.	Comment Noted.
	9.3	In the event further questions or issues arise from the supporting documents, we will address our concerns in written letters.	Comment Noted.

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City of Westminster Comments
Draft Interim Measure/Interim Remedial Action (IM/IRA) for the Original Landfill

	Comment No. (Ref)	Comment	Response
		General Comments	
		The City of Westminster is very disappointed that we were not granted additional time to do a more comprehensive review of these documents. We do not understand why that when Broomfield, the Rocky Flats Coalition of Local Governments (RFCLOG), the Woman Creek Reservoir Authority (WCRA) and we have all asked for an extension, it wasn't approved. This is the first time that we have not been granted an extension of the "Comment Period" after having asked for one. The reason provided to us was the "construction schedule of the project". This is the first time that Kaiser-Hill (KH) and the Department of Energy (DOE) have publicly stated that they are being schedule driven. We find this an entirely unsatisfactory reason. The addition of 15 working days for extra review is a minute amount of float in the schedule for this action.	DOE was unable to extend the comment period past 45 days for the Original Landfill IM/IRA because of the schedule demands for the Original Landfill project, and because of this project's potential impact on the overall schedule for the Rocky Flats Closure Project. In order to mitigate the impact of this on those reviewing the document, we extended the comment period for the Groundwater IM/IRA to February 10th, allowing reviewers to focus on the Original Landfill IM/IRA. In addition, we held several informational meetings to provide assistance to reviewers. Finally, we responded to comments received after the formal closing of the comment period, thereby providing a *de facto* extension. As the Closure Project nears completion, it is possible that, in the coming months, we will be similarly unable to extend the comment periods for other regulatory documents. As with the Original Landfill IM/IRA, we will continue to work with the public to ensure, to the best of our ability, that comments on these documents are received and considered.
		Secondly, we again voice our concern that when these documents were presented to us that you did not have all pertinent parts of the documents available in order to make whole documents available for review. For example, you said the comment period started on December 6th, but we did not receive the documents until December 13th; we did not receive the Applicable or Relevant and Appropriate Requirements (ARAR) analysis until December 21st; the specifics of the sampling and surveillance criteria were received on January 10; and, the Proposed Remedial Action Plan contained in the draft IM/IRA was changed and presented to us on January 11 and that there were still portions of this alternative still under development. We believe that the documents pertaining to the remedial action should not have been submitted for formal public comment until they included everything necessary to derive an informed opinion. Therefore, the public comment period should not have begun until after all documents related to the remedy were finalized and available for review. We reserve	The IM/IRA and the supporting documents were hand delivered to the City of Westminster on December 6, 2004. Please note that the ARARs analysis is not part of the IM/IRA document and was provided as a courtesy to stakeholders who requested it. The IM/IRA commits the DOE to groundwater and surface water monitoring after the accelerated action construction is complete. The groundwater and surface water sampling locations were being developed with the EPA, CDPHE and the members of the Water Working Group after the IM/IRA was issued for public comment. The presentation of these locations is not a requirement in the IM/IRA; however, they were provided to the stakeholder as requested and they will be included in the final IM/IRA.

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		the right for a 45 day public comment period on the details of the final design when it is competed.	The IM/IRA does include the information on Alternative 3 that allows for the comparative evaluation of all the alternatives. The IM/IRA is therefore complete for the selection of the preferred accelerated action. Alternative 3 as presented in the IM/IRA will become the selected accelerated action based on discussions with the regulators since the IM/IRA was issued for public comment. There is no public comment period for detailed designs in RFCA.
		We are also extremely displeased in KH's not being cooperative in sending the documents to the consultant obtained by the WCRA even after repeated attempts by the City to have them do so. Delivering an extra copy of the documents to us, just delayed our ability to have the consultant begin his review in a timely manner.	Comment noted. However, the OLF IM/IRA and supporting documents were on the RFETS web site and available for anyone to review.
		There is no alternatives analysis for terracing the landfill. This is a reasonable alternative that should have been thoroughly analyzed and included in the alternatives analysis. Please include a detailed analysis of this alternative in the document.	Terracing is not required to establish a stable landfill configuration.
		The delay in issuing the ARARs appears to suggest that the IM/IRA was developed to arrive at a preferred alternative and then the ARARs were written in support of the selected preferred alternative.	The ARARs analysis was prepared in the summer of 2004 and endorsed by the regulators before the draft of the IM/IRA was completed for public comment. Please also note that the ARARs analysis is not part of the IM/IRA document and was provided as a courtesy to stakeholders who requested it.
		It is our belief that the site chose the proposed remedy without regard to the comments and concerns that the City had expressed numerous times in the past. We are concerned that as of this date, there is no specific design of the cap or justification for the preferred proposal. The original landfill is located within a landslide area and the long-term stability of the area and associated waste is of key concern to us.	We acknowledge your comments concerning the proposed accelerated action. The final design and specifications for the proposed accelerated action is underway and geotechnical calculations based on actual data from the OLF have determined that the action will be stable.
		Specific Comments	
		ARARs Analysis, Summary of Waste Disposal at the Original Landfill, page 1	
		The City disagrees with the ARAR analysis of 265.310(a) (5), permeability requirements and that they are not relevant and appropriate. Groundwater data for metals, radionuclides, and organic compounds have been detected in groundwater at concentrations above background and the Tier II action levels (ALs). Though the concentrations are not consistent, permeability should be a factor.	Groundwater data show very low levels of contaminants within the landfill boundary, decreasing concentrations of contaminants over time, and no migration beyond the boundaries of the landfill. Based on the National Contingency Plan, its Preamble, and EPA's guidance on determining relevant and appropriate requirements, when these conditions exist, section 265.310(a)(5) would not be relevant and appropriate in this situation. Please note that the ARARs analysis is not part of the IM/IRA document and was provided as a courtesy to stakeholders who requested it.

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		The City disagrees with the ARAR analysis of 255.310 (a) (1), infiltration requirement and that they are not relevant and appropriate. Groundwater data for metals, radionuclides, and organic compounds have been detected in groundwater at concentrations above background and the Tier II action levels (ALs). Though the concentrations are not consistent, infiltration should be a factor.	Groundwater data showed very low levels of contaminants within the landfill boundary, decreasing concentrations of contaminants over time, and no migration beyond the boundaries of the landfill. Based on the National Contingency Plan, its Preamble, and EPA's guidance on determining relevant and appropriate requirements, when these conditions exist, section 265.310(a)(1) would not be relevant and appropriate in this situation. Please note that the ARARs analysis is not part of the IM/IRA document and was provided as a courtesy to stakeholders who requested it.
		"Because of the existence of these other areas and the records and other information about the hazardous wastes disposed there, it is unlikely that the Original Landfill was a primary depository for hazardous materials waste at the Rocky Flats or even that it received a significant amount of hazardous material." Contrary to this statement, when representatives of KH and DOE were asked, "Can you guarantee that there are no hazardous constituents in the landfill", they responded, "No".	It cannot be guaranteed that there are no hazardous constituents in the landfill. EPA's regulation and guidance assume that all landfills, including sanitary landfills, contain at least a small amount of hazardous materials. As stated in the IM/IRA, however, all available information leads to the conclusion that the Original Landfill was not a primary depository for hazardous materials waste and did not receive a significant amount of hazardous material.
		Also, the <u>Data Adequacy for the Original Landfill IM/IRA Decision Document</u>, states, ***"Based on historical records, the Original Landfill site is estimated to contain approximately 70,000 cubic yards (cy) of buried miscellaneous RFETS wastes, including solvents, paints, paint thinners, oil, pesticides, cleaners, construction related debris, waste metal, and glass (Kaiser Hill 1996). It is believed that solvents buried include trichloroethene, carbon tetrachloride, tetrachloroethene, petroleum distillates, 1, 1, 1-trichloroethane, dichloromethane, and benzene (EG&G 1994C). Metals such as beryllium, lead, and chromium may also be present (Rockwell 1988). In addition, the site received waste materials with unknown concentrations of polychlorinated biphenyls (PCBs) in the 1960s. The material consisted of no-carbon required paper, transformer and vacuum pump clean-up paper and rags, and small capacitors and fluorescent light ballasts (EG&G 1992). Uranium ash is also reported as having been buried in the landfill (Kaiser Hill 1996). Accurate and verifiable records of any further wastes buried at the site are not available (Kaiser Hill 1996). Also, the Site Characterization Summary (Kaiser Hill 2002A) provides information on the various specific chemical contaminants that have been identified in the RI/RFI.***	Section 2 of the IM/IRA acknowledges that relatively small quantities of wastes containing hazardous constituents were possibly placed in the landfill. The IM/IRA further states that routine disposal of radioactive material or hazardous wastes were managed at other locations within the RFETS and not at the OLF. These statements in the IM/IRA are supported by the environmental data reviewed and summarized in Section 4 of the IM/IRA.

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		Additional classification would be required for waste disposal, and the exact volume of low-level radioactive, RCRA hazardous waste and solid waste in the landfill has not been determined. For the purpose of determining waste classification, it will be assumed that during extraction, solid, hazardous, mixed, and low-level radiological waste will be encountered." This does not support your contention that there are not hazardous constituents in the original landfill.	
		Relevant and Appropriate Analysis for the OLF Cover, page 3	
		"...there is no evidence that hazardous waste was disposed at the landfill." See above comments. Revise this statement.	See response to previous comment.
		Relevant and Appropriate Analysis for the OLF Cover, page 10	
		"However, the OLF no longer has settling or subsidence concerns from the waste material since the waste has been in place for over 35 years." There is evidence of recent settling and subsidence problems. Revise.	Please note that the ARARs analysis is not part of the IM/IRA document and was provided as a courtesy to stakeholders who requested it. There is no physical evidence that the OLF is settling. However, subsidence is predicted as a part of the final design of the accelerated action. Subsidence after completion of the accelerated action is believed to be very small and a minor concern given that natural soil is placed and compacted for the construction of the landfill cover.
		Comment on the Draft IM/IRA	
		Section 1.2, Proposed Accelerated Action – The Municipal Landfill Presumptive Remedy, page 1-5	
		We are concerned as to why the site has selectively applied the "Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills, OSWER Directive No. 9355.0-67FS". When the City has cited OSWER directives that had application during past remediation efforts, we were told that they are for guidance only and not applicable.	The OSWER Directive No. 9355.0-67FS is guidance that is pertinent to the identification of accelerated action alternatives for landfill types that are similar to the OLF. Thus, the information in the guidance was considered in identifying the source containment remedy as a possible viable alternative for the situation posed by the OLF. The other OSWER Directives this comment refers to, though no specifics are mentioned, were in all likelihood not pertinent to the situation then at hand.
		The similarities between a military landfill and the OLF could be argued, however the other landfills do not have long-lived contaminants such plutonium, americium, strontium, or uranium in their groundwater.	While specific ground water contaminants are not discussed in the OSWER Directive, ground water contamination must be considered in developing the components of the containment remedy. While radionuclides have been detected in ground water samples from within the OLF boundary, the

			number of samples with concentrations above Tier II action levels are low and do not result in identifiable plumes (which is also true of non-radionuclides in ground water). While certain radionuclides are "long-lived" the same is true for many hazardous substances that are non-radionuclides, in particular, the stable elemental metals, which are components of some military landfill type wastes discussed in the Directive.
		The presence, proportion, distribution, and nature of waste are fundamental to the application of the containment presumptive remedy for landfills. The presumptive remedy does not include land application areas such as surface impoundments. The OLF did include an impoundment that received blow down from the water plant; therefore once again the presumptive remedy does not apply.	The Filter Backwash Pond, IHSS 196, has not been an identifiable surface impoundment since at least 1964. Its use in holding backwash was apparently short lived. However, there is no evidence that backwash from the treatment of raw water delivered from Denver Water Board reservoirs to render it fit for use as RFETS potable water presented any risks that would be higher than those associated with the OLF debris type wastes. Thus, source containment is appropriate for the IHSS 196 area since it is within the OLF boundaries.
		The guidance identifies sensitive environments that may limit the use of the containment presumptive remedy at military landfills. The presence of high water tables is used as an example that would limit the use of the presumptive remedy. The OLF has high water tables. The proposed design will not minimization migration of groundwater plumes into and through the area. Once again the presumptive remedy would not apply based on the presence of high water tables in the area.	The OLF and adjacent area water tables have been considered in evaluation of the OLF remedy alternatives, including the source containment alternative. Migration of ground water has never been controlled at the OLF and after more than 35 years since use of the OLF ended there is no indication of a particular ground water contamination situation that needs to be addressed in the OLF IM/IRA.
		We disagree with the following statement within the presumptive remedy: *These types of wastes are specific to military bases but generally are not more hazardous than some waste found in municipal landfills.* Low-level radioactive wastes are identified as a waste type in the presumptive remedy. We disagree with the statement that low-level waste may be as harmless as most wastes within a solid waste (municipal) landfill. Per today's regulatory guidelines, any landfill receiving radioactive waste must have a Nuclear Regulatory Commission (NRC) license.	The particular risk posed is dependent on the concentration, physical and chemical form and particular type of any hazardous substance, including radionuclides. Small amounts and low concentrations of radionuclides in waste generally do not pose risks that are more significant than many other types of hazardous substances at similar concentrations and quantities found in military facility landfills for which the source containment remedy is appropriate.
		It is our belief that your use of the referenced directive does not have applicability as the original landfill was neither a municipal landfill nor a military landfill. If you maintain that this directive is applicable, there needs to be a very convincing justification added to the IM/IRA.	Note that the IM/IRA evaluates the presumptive source containment remedy as one possibly viable alternative. The Directive is used because it is pertinent to specific types of landfills similar to the OLF and thus the information and remedy approach discussed in the Directives serve as guidance in performing the evaluation. Other alternatives analyzed and compared to the presumptive remedy are no action and removal of the waste. In addition, the source containment evaluation considered two containment alternatives, soil cover and soil cover with buttress fill.

		Section 2.2, Description and History of IHSS 115 (OLF), page 2-3	
		"...organics, paint and paint thinner, oil, pesticides, and cleaners." *"...trichloroethene, carbon tetrachloride, tetrachloroethene, petroleum distillates..."* *"...some waste contaminated with radioactive material..."* *"...60 kilograms (kg) of DU were placed in the landfill..."* *"Efforts were later made to retrieve the DU, however, only 40 kg were recovered".* These statements contradict the statement quoted under ARARs Analysis, Summary of Waste Disposal at the Original Landfill, page 1, above.	See response to 4th comment under "ARARs analysis, Summary of Waste Disposal at the Original Landfill."
		Section 3.7, Surface Water, page 3-12	
		"With completion of the Woman Creek Reservoir, located just east of Indiana Street and operated by the City of Westminster, Woman Creek flows are detained in cells of the reservoir until the water quality has been ensured by monitoring of RFETS discharges via Woman Creek Reservoir into the Walnut Creek Drainage below Great Western Reservoir". The City of Westminster does not operate the facility. The Woman Creek Reservoir Authority operates it.	The text will be revised.
		We again state our position that there is a misconception that the Woman Creek Reservoir (WCR) can be considered to serve as a terminal pond for the Woman Creek Basin. WCR and related facilities including the pump station and pipeline was a structure built by the Standley Lake cities and paid for by the DOE for protecting the drinking water supply of Westminster, Thornton and Northglenn, and Standley Lake agricultural users. The WCR was built to physically separate Woman Creek Basin and the Rocky Flats facility from Standley Lake and to provide a means to bypass Woman Creek water around Standley Lake. It was not conceived nor constructed to be used as an additional terminal pond or settling pond for Woman Creek or any Rocky Flats site runoff. When one is looking at the Woman Creek drainage and ponds C-1 and C-2 and what the ponds provide, one should not infer that WCR is there for the same purpose.	Comment acknowledged.
		The Rocky Flats Cleanup Agreement, Attachment 5, dated May 28, 2003, specifically states, "The Standley Lake Protection Project (SLPP) Operations Agreement addresses conditions and timing of storage and releases of waters	Comment acknowledged.

		in the Woman Creek Reservoir. Consistent with the SLPP Operations Agreement, it is the intent of the Parties that waters which meet the standards at the Indiana Street POC are ***acceptable for any use*** (emphasis added)."	
		Section 4.1, Site Characterization Plan, page 4.1 and Appendix B, Environmental Data Tables	
		The site is taking credit for, as they say, "50 years of data". Yet the document states, *"The data used to characterize the nature and extent of the contamination in and around the OLF were collected primarily in the early 1990s..."*	Section 4.1 is clear on the data used for the OLF action level comparison.
		Also, in Appendix B, under Analyte Group, there is no specificity as to what radionuclide (Pu, Am, U), what metal, what VOC, what SVOC, what pesticide was sampled for; nor a listing of the results for the samples taken. Please revise the list to identify the specific constituent sampled and the sample results. Also, add two columns that will compare the sample results to the Tier I and Tier II RFCA action levels for each analyte.	Data have been summarized and graphically portrayed to present the characterization of contamination in all environmental media at the OLF. The detail requested for Appendix B would be voluminous. All data has been provided electronically on a CD and will be included in the final IM/IRA. In general, the terms VOCs, SVOCs, pesticides, and PCBs means all analytes measured by SW846 Methods 8260, 8270B, 8081A, and 8082, respectively.
		Section 4.2, Data Compilation and Evaluation, page 4-2	
		Add a section that defines RFCA Tier I and Tier II action levels.	The basis for all ALs, including Tier I and II ALs for groundwater, are presented in Attachment 5 of RFCA. Text will be added to the IM/IRA to include RFCA, Attachment 5.
		Section 4.9, Risk Assessment, page 4-13	
		"The need for and extent of long-term stewardship activities will be analyzed in the RFI/RI and CMS/CS and will be proposed, as appropriate, as part of the preferred alternative in the Proposed Plan for the Site". Since the proposed action is a final remedy, the IM/IRA shall capture all the elements of long-term stewardship. It needs to be detailed here, not in another document. Please add all long-term stewardship activities for the remedy to this section.	The IM/IRA is not the final remedy for the OLF. While the proposed source containment accelerated action is consistent with actions that would be required for final closure of the OLF, final closure requirements will be proposed, as appropriate, as part of the preferred alternative in the Proposed Plan for the RFETS site.
		Section 5.0, Remedial Action Objectives, page 5-1	
		"...an accelerated action consistent with the municipal and military presumptive remedy of source contaminant after hot spot removal (completed in August 2004) is appropriate for the OLF". The City does not agree with the two identified remedial action objectives (RAOs) identified in the document The two RAOs identified in the IM/IRA	The RAO's were determined based on the physical conditions and the environmental data at the OLF. Based on this information, the accelerated action should prevent direct contact with exposed waste materials and provide for a structurally stable configuration. The environmental data, show that the infiltration of water through the landfill as it has done since 1950, has not impacted the downgradient groundwater or surface water

		only address prevention of direct contact with waste and accommodation of surface water runoff to minimize erosion. The RAOs are clearly deficient in identifying the corrective action objectives required for the OLF. The design of the cap should *achieve long-term minimization of migration of liquids through the hazardous waste*. We understand groundwater is not a potential source of drinking water at Rocky Flats, but one of the key goals of RFCA is to protect groundwater that will impact surface water. The proximity of the OLF to Woman Creek and the ability for groundwater to surface in the drainages should be justification to minimize migration.	along the OLF.
		See comments under Section 1.2, Proposed Accelerated Action – The Municipal Landfill Presumptive Remedy, page 1-5	See response to comments for Section 1.2.
		Was this OSWER directive applied as a means to circumvent more restrictive regulatory requirements?	No. Note that the IM/IRA evaluates the presumptive source containment remedy as one possibly viable alternative. The Directive is used because it is pertinent to specific types of landfills similar to the OLF and thus the information and remedy approach discussed in the Directives serve as guidance in performing the evaluation. Other alternatives analyzed and compared to the presumptive remedy are no action and removal of the waste. In addition, the source containment evaluation considered two containment alternatives, soil cover and soil cover with buttress fill.
		Section 6.1.2, Alternative 2 – Soil Cover, page 6-5	
		"Work would be suspended when environmental conditions could greatly increase the possibility of the spread of contaminated materials". The document needs to be revised to identify what environmental conditions (wind, rain, etc.) and at what strength (mph, inches, etc) would trigger the suspension.	The final design and the work control documents will define conditions where work would be suspended consistent with RFETS safety processes and procedures.
		Section 6.1.3, Alternative 3 – Soil Cover with Buttress Fill, page 6-5	
		During the meting on January 11, Bob Davis said the buttress would be constructed of Rocky Flats Alluvium, which contains sufficient clay-like properties to work well for the fill. Section 3.3.1, page 3-2 says the following: *"The alluvial deposits generally consist of beds and lenses of poorly sorted, clast-and matrix-supported, white-to-pink, sandy, cobbly gravel, gravelly sand, and silty sand".* It appears from this description of Rocky Flats Alluvium that there is no clay	Borrow sources of the Rocky Flats Alluvium that have been used at the site contain significant clay like fractions to provide a very stable compacted fill. Geotechnical soil testing has classified the Rocky Flats Alluvium as a Clayey Gravel with about 20% clay fines.

		in the material. Please explain?	
		During the same meeting, Dave Shelton, said that the Rocky Flats Coalition of Local Governments liked the idea of a buttress fill. While true that SOME (emphasis added) members of RFCLOG voiced a better acceptance of a cover containing a buttress than one without, the City of Westminster never supported this opinion.	Comment noted.
		If a buttress is constructed, it needs to be tied into the unweathered bedrock for better stability.	The geotechnical design of the buttress will determine the position of the buttress relative to the weathered/unweathered bedrock to provide a buttress that will meet landfill guidance.
		"The buttress fill would be built by placing specified structural fill soil in loose lifts and compacting the lifts to a desired relative compaction requirement." The details of the buttress fill requirements need to be fully included in the document describing how the lifts will be placed; in what depth; what compaction requirements will be used; what will be the QA/QC requirements applied; and, how will the tests be conducted, documented and by whom?	The IM/IRA outlines the basic concepts of the accelerated action that forms the basis of the final design. The final design will include compaction requirements, and the QA/QC requirements including documentation. The IM/IRA will not include the design and specifications needed for construction of the accelerated action.
		What is being used as a biota barrier? There is no description within the document or from any briefings of a biota barrier.	Based in the limited environmental impact of the OLF no biota barrier is required as a part of the accelerated action.
		The IM/IRA does not address how the headwaters of the buttress will be dispositioned. At the January 11th meeting, K-H informed us the headwaters would be rerouted underneath the buttress and allowed to drain into Woman Creek. Before the water is rerouted, the water quality should be known before it is allowed to migrate into the Woman Creek drainage. DOE should be working with impacted asset holders to determine how best to manage the groundwater flowing through the OLF. Include the details for the perimeter ditches. Describe how they will be constructed, where they will release to; how they will release; and, where will the water go?	Groundwater monitoring wells, as presented at the January 11, 2005 meeting, will be installed to monitor the groundwater downgradient of the buttress fill and before the groundwater reaches Woman Creek. Precipitation run-on and run-off controls will be defined during the final design of the accelerated action and incorporated into the work control documents that are implemented before the construction work begins.
		The document does not clearly define how surface water will be managed on or around the OLF. Revise the document to include the controls to prevent run-on of the OLF and control run-off of the cap. How and where will sheet flow from off the cover be directed?	Precipitation run-on and run-off controls will be defined during the final design of the accelerated action and incorporated into the work control documents that are implemented before the construction work begins.
		At the January 11th meeting K-H suggested a berm may be constructed upgradient of the OLF and two drainage ditches would be constructed on the east and west side of the OLF that would capture and divert precipitation. The ditches would then fan-out and allow the surface water to flow onto the surface soil. We understand the proposal, but once again the details of the	These items are design considerations and will be a part of the final design of the accelerated action. Erosion controls will be designed into the accelerated action to reduce the sediment load into Woman Creek.

		surface water system should be included within the document. Revise the document to include as a minimum the following: • Physical characteristics of the berm (concrete, compacted soils); • Flow capacity of the ditches; • Design of the surface water ditches and berm; • Location of areas where surface water will be released on surface soils; • Utilization of rip-rap and maintenance criteria should also be included; • Sampling criteria, if any for the diversion system; • Vegetation criteria for the diversion system; • Contingency in the event burrowing animals impair the system; • We are very concerned with an 18% slope and the ability to maintain and repair the proposed system, therefore inspection criteria should be identified in the document, In the event of a major storm event, sheet flow with heavily laden sediments may be transported into Woman Creek and the document should address the sediment loading into Woman Creek and the long-term impacts.	
		Table 6-1, Summary of Comparative Evaluation of Potential Remedial Alternatives, page 6-10	
		Revise this table to include a summary analysis of the terracing alternative.	Terracing is not required to establish a stable landfill configuration.
		Table 6-1 does not evaluate the effectiveness of an upgradient cutoff such as a slurry wall. Revise the document to include the long-term effectiveness of the slurry wall and the impacts to the stability factors	As presented in the hydrogeologic modeling supporting report to the IM/IRA, the installation of an up-gradient groundwater cut-off wall does not significantly alter the groundwater levels and flows at the OLF. Therefore a slurry wall or groundwater cut-off component to the accelerated action was not proposed.
		Under Regulatory/Community Acceptance for the potential remedial alternatives; while the stated acceptance might be applicable to the regulators, the City's rating would be as follows: Alternative 1 Low Alternative 2 Low Alternative 3 Low to Moderate Alternative 4 High And if you include terracing High	Comment noted.
		Section 6.2.3, Alternative 3 – Soil Cover with Buttress Fill, page 6-13	

		"Alternative 3 would comply with ARARs". The delay in issuing the ARARs (December 21 vs. December 6 for the IM/IRA) appears to suggest that the IM/IRA was developed to arrive at a preferred alternative and then the ARARs were written in support of the selected preferred alternative.	The ARARs analysis was prepared in the summer of 2004 and endorsed by the regulators before the draft of the IM/IRA was completed for public comment. Please also note that the ARARs analysis is not part of the IM/IRA document and was provided as a courtesy to stakeholders who requested it.
		Section 6.2.3, Alternative 3 – Soil Cover with Buttress Fill, page 6-17	
		"Alternative 3 would most likely gain CDPHE, EPA and community acceptance more readily than Alternative 2". We do not accept this alternative. The City has commented many times in the past that the City does not support the use of a Subtitle D – Solid Waste Landfill Cover as a proper remedy for the original landfill. Therefore, we are disappointed that this is the proposed alternative that the DOE is recommending.	Comment noted.
		We have been told on numerous occasions that the contents of the landfill cannot be described fully or with 100% accuracy, as records do not exist as to what entirely was disposed of in the landfill. To say that the landfill has been there for a long period of time and that in the last 35 years nothing has appeared to cause concern does not provide the necessary guarantee that nothing will happen in the future. Slower moving contaminants may not have yet migrated to groundwater wells to evaluate plume migration.	As present in Section 4 of the IM/IRA, both soil and groundwater sampling within the OLF do not support that there is a source or plume of groundwater contamination emanating from the OLF. This was also substantiated by the fate and transport modeling conducted in support of the IM/IRA. Groundwater monitoring data will be evaluated quarterly, presented in an annual monitoring report and included in the CERCLA 5-year reviews.
		We believe at a minimum, a Subtitle C – Hazardous Waste Landfill Cover is required based on historical information that metals, PCEs, contaminated material, and both VOCs and semi-VOCs have been disposed of into the landfill.	Based on the environmental data and the geotechnical and hydrogeological evaluations, the proposed accelerated action will provide a stable containment of the OLF and meet or exceed landfill guidance requirements.
		Section 7, Proposed Remedial Action Plan, page 7-1	
		Based on the assumptions that alternative 3-Soil Cover with a Buttress Fill is the preferred remedy; we have the following concerns/issues:	
		• Implementation of the presumptive remedy by placement of a soil cover does not require the cover to meet the infiltration criteria to prevent precipitation from contributing to degradation of groundwater quality or additional migration of groundwater.	Infiltration has been occurring during the life of the landfill and since its inactive status in 1968, with no impact to downgradient groundwater or surface water along the OLF. The proposed accelerated action will reduce the infiltration from the existing conditions as presented in the IM/IRA, but is not required based on the environmental data and is not an ARAR.
		• Based on the fact that the original landfill is within a landfill area, the proposed 18-percent (5.5:1) slope is extremely steep for this area.	The stability calculations in the geotechnical report supporting the IM/IRA use existing and new geotechnical data to determine the structural stability

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			Subtitle C landfills usually have a 5-8% slope to ensure the stability of the cover. We at this time do not feel comfortable with the 18% slope based on the location of the area.	of the landfill. With these data, stability calculations are made as the landfill exists today and with the re-grading of the landfill surface and the installation of a buttress fill at the toe of the landfill. The stability of the proposed accelerated action is then determined under static conditions, and very conservatively in wet-year conditions with a major seismic event. The calculations show that the landfill can be designed into a stable structure exceeding the design criteria established by landfill guidance documents. Additionally, a 5% slope is not proposed because to achieve this low slope angle, the existing stream channel of Woman Creek would be covered, requiring re-channelization or large culverts, and disrupting a large section of excellent ecological habitat, both Prebles's Mouse habitat and wetlands.
			• Control measure to control the spread and release of waste materials and cross contamination are not identified within the document. Based on the recent release of contamination from the B771/774 project, we question the application of control measures to prevent a release of contamination into Woman Creek. Revise the document to include the control measures and methods to control run-off and run-on.	Precipitation run-on and run-off controls and dust controls will be defined during the final design of the accelerated action and incorporated into the planning that is implemented before the construction work begins.
			• The plan does not identify the size of area to be capped at one time, nor does it identify the process in which the cover will be placed. Controlling the size of the area controls cross contamination and decreased the potential for particulate erosion into Woman Creek. Revise the document to identify the specific control measures for the project.	Dividing the construction into areas is one way to manage control of run-off and dust, and will be considered in the final design and construction planning.
			• The document does not discuss the possibility of encountering classified parts or the procedure to follow in the event a part is discovered. Revise the document to include the process that will be implemented in the event a part is discovered.	This comment is not within the scope of the IM/IRA, but encountering classified objects will be addressed and managed by existing RFETS procedures. The work control documents will describe the process to be followed when buried waste is uncovered.
			• The document does not identify the borrow area for the source material. Revise the document to include the borrow area, soil classification, and specifications for placement of the buttress. To simply state *the soil cover will be compacted sufficiently to provide a stable cover system ....and provide a suitable soil surface for revegetation*, does not provide us with assurances the buttress will be effective for the long-term.	The final design will define the material and execution specifications for the accelerated action. The source of the borrow materials will be determined during the construction planning process.
			• The document does not identify the floodplain for a 15, 25, 50, or 100-year storm. In the event of each storm, revise the document and include a map of the floodplain for each event and the proximity to the buttress.	A floodplain analysis will be added to the IM/IRA in the section on environmental impacts consistent with the substantive requirements of the 10 CFR 1022 listed in the ARARs table.
			• Alternative 3- Soil Cover with Buttress Fill identifies the *possible construction of an upgradient groundwater "cutoff" wall immediately*	As presented in the hydrogeologic modeling supporting report to the IM/IRA, the installation of an up-gradient groundwater cut-off wall does

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		north of the OLF. The City is concerned that a groundwater cutoff such as a slurry wall will not be constructed to prevent upgradient lateral inflow of groundwater into the landfill and cross contaminating clean groundwater. The intent of closure of a landfill is not only to prevent infiltration via precipitation from impacting groundwater, but also to prevent other environmental media from becoming contaminated by coming into contact with waste or any other environmental medial contaminant. The City does not support a closure remedy for the OLF without the construction of an upgradient cutoff such as a slurry wall.	not significantly alter the groundwater levels and flows at the OLF. Therefore a slurry wall or groundwater cut-off component to the accelerated action was not proposed.
		• Westminster is concerned the continued impact of groundwater inflow on the underlying soils and bedrock may contribute to potential sliding in this area. The long-term stability of the OLF can be greatly enhanced by providing an engineered structure upgradient of the OLF to prevent groundwater inflow into the area.	The geotechnical evaluation presented in the supporting report to the IM/IRA considers 100-year wet conditions and clearly shows that the OLF is stable under high groundwater conditions after the proposed accelerated action is implemented.
		• The document states subsidence may occur within the area once the cover is placed. Revise the document to include the basis for the identified amount of subsidence (1-2 feet). Also include the evaluation criteria to determine subsidence and the corrective action to be taken in the event of subsidence.	Subsidence is predicted as a part of the final design of the accelerated action. Subsidence is a minor concern given that natural soil is used as the cover for the landfill and that any subsidence can easily be repaired. Subsidence monitoring data will be evaluated quarterly, presented in an annual monitoring report and included in the CERCLA 5-year reviews
		Section 7.4, Site monitoring, page 7-3	
		The details of the sampling and monitoring to be performed for groundwater and surface water need to be included. The document needs revised to identify the groundwater and surface water wells that will be maintained; the analytes that will be sampled for; the sampling frequency; the RFCA Tier I and Tier II action levels for the analytes being sampled; and, the contingency plans for exceedences. We also want sampling conducted for Pu and Am during the initial five year period to establish a baseline	Surface water and groundwater monitoring locations will be included in the IM/IRA. The analytes, sampling frequency, comparison criteria and possible follow-on actions are included in Section 10 of the IM/IRA. Section 10 will become an appendix to the IM/IRA and include both groundwater and surface water monitoring locations. The monitoring locations will be incorporated into the IMP and post-accelerated action monitoring plans.
		Westminster is concerned the proposed remedy is not designed to provide long-term minimization of migration of liquid through the closed landfill. Engineered controls should be constructed upgradient of the OLF to prevent groundwater from flowing through the waste and the landfill area. We are not able to evaluate the engineered design of the groundwater drainage associated with the buttress because it was not included in the document. The document should also include surface water management controls to prevent run-on/run-off to reduce the amount of infiltration into the OLF area and mitigate potential impact to water quality in Woman Creek. The location of the Original Landfall is unique because of the potential for direct impacts from both groundwater and surface water to Woman Creek. The IM/IRA	As presented in the IM/IRA, the landfill has been inactive for over 35 years and the groundwater has been monitored since 1991. A review of this data and considering the most recent groundwater data (2003), the OLF has not impacted the downgradient groundwater quality. Similarly, a review of the data indicates that the OLF is not impacting the water quality of Woman Creek. Groundwater and surface water monitoring data will be evaluated quarterly, presented in an annual monitoring report and included in the CERCLA 5-year reviews The proposed accelerated action includes run-on and run-off controls as presented in the IM/IRA. These controls will be defined in the final design

		should be revised to include the details of the engineered design and the community should be afforded the opportunity to review the proposed designs.	of the accelerated action. The IM/IRA outlines the basic concepts of the accelerated action that forms the basis of the final design.
		Westminster is very concerned the IM/IRA does not discuss the need to provide long-term minimization of migration of liquids through the closed landfill. One of the most important design criteria for a cover is to prevent migration of liquids through and into a landfill. Revise the preferred remedy to include engineered controls to prevent the infiltration of groundwater through the OLF.	Infiltration has been occurring during the life of the landfill and since its inactive status in 1968, with no impact to downgradient groundwater or surface water along the OLF. The proposed accelerated action will reduce the infiltration from the existing conditions as presented in the IM/IRA, but is not required based on the environmental data and a review of the Subtitle C ARARs.
		We would also like the following groundwater wells retained to monitor the proposed groundwater drainage around the buttress fill: 43392 59894 60693 59394 62893	Comment noted. The groundwater monitoring locations have been selected based on the knowledge of the OLF groundwater characteristics and historical sampling data. Based on this knowledge, the proposed sampling locations will adequately monitor both the up-gradient and downgradient groundwater conditions. In addition, the DOE will continue to work with the stakeholders on the development of a long-term surveillance and maintenance plan.
		We would also like the following surface water wells retained to monitor the proposed surface water drainage over the cover: SW506 SW50193	Comment Noted. The surface water monitoring locations have been selected based on the knowledge surface water characteristics and historical sampling data. Based on this knowledge, the proposed sampling locations will adequately monitor both the upstream and downstream surface water conditions. In addition, the DOE will continue to work with the stakeholders on the development of a long-term surveillance and maintenance plan.
		Section 7.5, Institutional Controls, page 7-4	
		"8. Upon completion, fencing at specific locations on or around the cover, will also be considered..." The City is in support of adding a fence around the entire perimeter of the cover in order to provide defense in depth.	The OLF will be a part of the DOE retained land. The DOE is still considering the use of fences.
		Section 8.1.2, Accommodate Settling and Subsidence to Maintain Cover's Integrity, page 8-2	
		"The waste is currently commingled with soil (over 50 percent), which reduces the extent of settling and subsidence". Prove this statement true.	Boring logs for subsurface soil sampling and groundwater monitoring well installations (see the Draft OU-5 Phase 1 RFI/RI) indicates waste commingled with soil. Compaction of the re-graded surface of the landfill will result in further compaction of the soil around the waste and reduce the extent of settling and subsidence.
		Section 8.3, Surface Water, page 8-3	

		Detail how water used for dust suppression will be collected and prevented from running into Woman Creek.	The details of dust control and water management will be developed in the final design of the accelerated action and the work control documents.
		Section 8.3.1, Stormwater, page 8.4	
		"Because the stormwater permit for construction activities is a general permit, it has been through public comment and promulgated by EPA". When did this occur, we have no recollection of having seen this permit to provide comment on it?	The Clean Water Act required EPA to issue storm water permits by 1989. The first general permits for storm water discharges were promulgated in the early 90s as part of the Phase I regulations. The initial general permit for construction activities covered projects that disturbed 5 acres or more. In fact, two projects at Rocky Flats fell under these permit conditions so Notifications of Intent were filed with EPA. One of those projects was the new landfill which, ultimately, was never used. However, stakeholders provided comments on the project throughout the process design and the issuance of various permits. The other project was the construction of the McKay by-pass, which was installed in cooperation with the stakeholders requests. Notifications of Termination were filed for each of those permits as required by regulation. Later in the 1990s, regulations for Phase II were promulgated, resulting in the current general permit for construction activities, which are now applicable to projects that disturb just one acre. Most neighboring municipalities also fall under the requirements of the Phase II regulations and were probably aware of the general permit provisions and comment periods. Municipalities Phase II permits are under state control, however, while the federal facilities in Colorado remain under the permitting authority of EPA. The Site's NPDES permit includes storm water provisions, but only for that part of the site upstream of the permitted storm water outfalls. While the eastern terminus of the South Interceptor Ditch (SID) is one such outfall (SW027), some storm water runoff from this project is not expected to be captured by the SID, so it falls under the jurisdiction of the aforementioned general permit. Public comment was available for the current NPDES permit; the comment period began in March 2000 and closed in June. The state issued 401 certification in July, and the permit became effective October 2000. It should be noted that the individual storm water permit provisions in this permit are very similar to the language of the general permit, which preceded this permit by almost a decade.
		Section 8.4, Wetlands, page 8-4 and Appendix E Wetlands Mitigation Plan	
		It is impossible to evaluate the wetland mitigation approach. We are not certain the wetland mitigation will be on-site at the toe of the OLF or off-	Until the final design is ready the actual impacts to the wetlands cannot be determined. The final locations of the buttress fill will determine whether

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		site.	wetlands can be re-established or not. If not, off-site wetland mitigation banks may be utilized.
		Without knowing the contouring of the final design, we cannot comment on the approach.	Comment noted.
		Previously EPA did not approve of either of the proposed banking areas due to the distance from Rocky Flats. Revise the document to include both EPA's and the Fish and Wildlife's approval of the proposed designated areas.	If an off-site wetland bank is used the first choice would be Standley Lake if credits are available. Other off-site banking approaches would be discussed and approved by the EPA. The USFWS is not involved with the wetland issues at the Site.
		If the DOE is considering the use of DOE's Standley Lake wetland mitigation bank, DOE needs to resolve the issue of providing an adequate water supply for the wetland bank with the City.	DOE is working with the EPA and USACOE to address the issues to get final approval on the Standley Lake wetland mitigation bank.
		Section 9.1.1, Potential Fugitive Dust Emissions, page 9-1	
		During construction, who will be the State certified opacity expert overseeing the construction and the release of fugitive dust emissions? How will this person document compliance with the State requirements?	Fugitive dust will be controlled consistent with the substantive requirements of CAQCC Regulation No. 1, which does not include the use of a certified opacity inspector.
		Section 9.2, Impacts to Surface Water, page 9-2	
		"The construction activities are expected to result in limited physical contact with contaminated soils or waste materials". Detail the procedures that will be followed in the event that contaminated soils or waste material is encountered.	During the preparation of the sub-grade for the cover, waste will most likely be encountered. Construction debris and other solid waste will not stop the construction; however, in the unlikely event that liquid wastes are found, the final design and work control documents will address the process and procedures to contain liquid wastes found during the sub-grade preparation work.
		"Precipitation falling within the boundary of the landfill will be drained from the cover and directed away from the landfill". Detail how precipitation falling within the boundary of the landfill will be collected and prevented from running into Woman Creek.	Precipitation run-on and run-off controls will be defined during the final design of the accelerated action and incorporated into the work control documents prepared before the construction work begins.
		Section 9.4, Impacts to Wildlife and Vegetation, page 9-4	
		"A Wetlands Mitigation Plan..." See comments under Section 8.4, Wetlands, page 8-4 and Appendix E Wetlands Mitigation Plan	See the corresponding response to comments.
		Section 10.1, Long-Term Stewardship	
		The locations of points of measurements (POMs) need to be included in the document. Action levels at the POMs need to be identified along with corrective actions in the IM/IRA.	Surface water and groundwater monitoring locations will be included in the IM/IRA.

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		We do not agree with the proposed 2 POMs that were discussed at the January 11th meeting. Further discussion is needed to determine the adequate siting of the POMs.	Comment noted.
		Any elevated concentrations or exceedences of ALs should be reported as per the current criteria. Downstream impacted governments should be notified the same time the regulators are notified	Comment noted.
		Section 10.1, Information Management	
		We currently support the Rocky Flats Reading Room at the College Hill Library as the identified location for maintaining the Administrative Record (AR). In the event DOE commits to funding an alternative location for the AR, we will then evaluate the proposed alternative. As an asset holder, Broomfield expects to have immediate access to data to evaluate impacts to our community.	Comment noted. This comment is beyond the scope of the OLF IM/IRA.
		The City expects to be able to review and comment on the Monitoring and Maintenance manual for the cover.	Comment noted.
		Table 10.1, page 10.3	
		Remove the words, "for five years" under each area of the frequency of action.	The text will be revised for clarity.
		The City concurs with this proposed frequency of action as detailed during the first five years and then will support a review of changing to a lesser frequency if monitoring and sampling reports support such an action. RCRA requires a 30-year monitoring period after remedy. The City supports that the cover monitoring be continued, for a minimum, through the 30-year period as required by RCRA.	Comment noted. Recognize that the OLF is not a RCRA unit for closure.
		The criteria listed are not criteria, they are what to look at or sample for. Criteria are the specifics of what to look for, analyze for or compare to. For example, criteria could include: • Settlement of greater than 6 inches must be repaired. • Cracks greater than 3 inches wide and 6 inches deep must be repaired. • Erosion rills/channels greater than 3 inches wide and 6 inches deep must be repaired. • Observe a corridor 100 feet outside of the cover perimeter for signs/evidence of land use changes, settlement/subsidence, and erosion, standing water, encroachment or noxious weeds. Revise the document to include specific criteria for each area.	Comment noted. These items will be considered in the OLF Maintenance and Monitoring Plan to be developed after the final design is completed.

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		Revise the document to add Area, Action, Frequency of Action, Criteria and Possible Follow-on Action for the buttress fill.	
		Section 10.4, Reporting Requirements, page 10-4	
		"Annual reporting of data results..." Ray Plieness of Legacy Management (LM) has assured us that LM will continue the Quarterly Data Exchange meetings post-closure. Revise this section to detail that agreement here	This comment is beyond the scope of the OLF IM/IRA.
		Document: Proposed Groundwater and Surface Water Monitoring at the Original Landfill We reserve the right to review the groundwater and surface water monitoring and sampling plans, the final cover design, and the Monitoring and Maintenance manual for the cover.	Comment noted.

Stephen F. Dwyer Comments (on behalf of the City of Westminster)
Draft Interim Measure/Interim Remedial Action (IM/IRA) for the Original Landfill

	Comment No. (Ref)	Comment	Response
		My concerns are summarized as follows:	
	1	The proposed landfill closure does not contain the waste. Groundwater currently passes through the waste toward Woman Creek where it continues toward the northern suburbs of Denver. There is nothing in the assumed remedy to prevent the continued movement of groundwater through the waste. The proposed cover is not designed to minimize percolation through it into the underlying waste. There is no proposed means to prevent or reduce biointrusion. Furthermore, there is no design basis that minimizes erosion. *{40 CFR 258 & 40CFR264/265}*	As presented in the IM/IRA, the landfill has been inactive for over 35 years and the groundwater has been monitored since 1991. The review of this data and including the most recent groundwater data (2003), clearly indicates that the OLF has not impacted the downgradient groundwater quality. Similarly, the review of the surface water data indicates that the OLF is not impacting the water quality of Woman Creek. Therefore, the long-term minimization of the migration of liquid through the landfill is not an RAO. However, implementation of the proposed accelerated action will eliminate the ponding (current condition) of storm water at the surface and provide for positive run-on and run-off control of storm water. The proposed accelerated action includes run-on and run-off controls and erosion control as presented in the IM/IRA. These controls will be defined in the final design of the accelerated action. The IM/IRA outlines the basic concepts of the accelerated action that forms the basis of the final design. Based on the limited environmental impact of the OLF, no biointrusion barrier is required as a part of the accelerated action. The cover and buttress toe of the OLF will be monitored for borrowing animals and corrective action will be taken as needed.
	2	The primary purpose of a landfill is to isolate the waste from the environment and contain the enclosed waste. This is accomplished by controlling vectors that can lead to contaminant release to the surrounding environment. The primary means of accomplishing this is to minimize percolation of precipitation into the waste and minimizing erosion. Other vectors include biointrusion whereby a biointrusion layer can be utilized and controlling surface waster runoff / run-on by incorporating an adequate surface water management system. The proposed remedy does not minimize the potential impact of these vectors. *{40 CFR 258 & 40CFR264/265}*	See response to comment 1 above.

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	3	There are a significant number of hazardous contaminants that have been identified at or near the site. These contaminants include VOCs, SVOCs, metals, and radionuclides such as uranium and plutonium among others. Many of the contaminants show up regularly while others show up intermittently. Testing for these contaminants has not been consistent. These wastes are potentially dangerous to human health and the environment. Additionally these wastes are long lived and difficult to remediate in an uncontrolled environment such as the one that exists at the site. *{40 CFR 258 & 40CFR264/265}*	Section 4.0 of the IM/IRA clearly shows that the OLF is not significantly contaminated. The comparison of this data with the environmental media specific RFCA action levels also indicates that the OLF is not potentially dangerous to human health and the environment. Also see response to comment 1 above.
	4	There was uranium surface contamination detected and removed from the site recently. It was assumed this contamination existed due to erosion of the soil cover that had been placed years ago thus exposing underlying waste and/or uncontrolled dumping of radionuclide contaminated waste on the surface of the OLF. However, there is no documentation or definitive information that explains how the radionuclides appeared on the surface. The waste could have been exposed by erosional processes or it could have been brought to the surface by burrowing animals. During my site visit, I noted several burrow holes on the landfill site. There are no current plans to place a biointrusion layer within or below the landfill to prevent biointrusion. *{EPA 1991}*	Section 2.0 of the IM/IRA discusses how the surface soil uranium contamination was placed on the surface of the OLF from a pallet of depleted uranium which caught fire. In addition, the wastes within the landfill have become exposed at the surface due to the random waste placement procedures (dumping from above) and surface erosion caused by the historical routing of surface water (stormwater) from the industrial areas of the RFETS.
	5	The waste was covered by an undetermined depth of soil in the past. The depth of soil was assumed to be several feet thick. The current suggested remedy is to apply the same remedy that did not work in the past. The only difference is that the slope will be regraded to an 18% grade versus the existing grade some of which is less than 18% while some is greater than 18%. With regard to the 18% grade, there was no technical justification presented showing that this change in grade would reduce the erosion. Commonly used techniques such as slope terracing, interceptor trenches, or surface gravel/soil admixture are not included in the presumed remedy despite the fact that the slope length has been more than doubled from the existing slope length. The existing slope length is broken by the existing road (see picture below) at the midpoint of the hill. The remedy design calls for an 18% slope from top to bottom of the hill, thus doubling the slope length. Possible changes to the landscape such as fire that could burn the surface	The stability calculations in the geotechnical report supporting the IM/IRA use existing and new geotechnical data to determine the structural stability of the landfill. With these data, stability calculations are made as the landfill exists today and with the re-grading of the landfill surface and the installation of a buttress fill at the toe of the landfill. The stability of the proposed accelerated action is then determined under static conditions, and very conservatively in wet-year conditions with a major seismic event. The calculations show that the landfill can be designed into a stable structure exceeding the design criteria established by landfill guidance documents. Additionally, a 5% slope is not proposed because to achieve this low slope angle, the existing stream channel of Woman Creek would be covered, requiring re-channelization or large culverts, and disrupting a large section of excellent ecological habitat, both Prebles's Mouse habitat and wetlands. *Terracing is not required to establish a stable landfill configuration at the*

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		vegetation planned to stabilize the soil against erosion are not addressed – these types of events are likely to be encountered considering the long lives of the contaminants of concern. Los Alamos National Laboratory has experienced significant erosional problems since the fire they experienced a few years ago and has expended a large amount of money and effort to mitigate continued problems. Southern California has experienced mudslides from thunderstorms that occurred after last summers fires – on slope grades similar to that planned for the OLF. *{40CFR258.20}*	OLF as presented in the supporting geotechnical report.
	6	There are a large number of animal burrow holes on the existing landfill. Without the presence of a biointrusion layer, burrowing animals will continue to inhabit the area and potentially bring waste to the surface. Furthermore, the presence of plants without an underlying biointrusion layer can bring many of these contaminants to the surface. Many of the present contaminants are capable of being taken up by plants. There are a number of vectors that can lead to the spread of these contaminants. These plants can then allow for surface contamination that can be blown from the area and spread, washed away with surface runoff, or ingested by fauna. An example of this is the infamous radioactive tumbleweeds that brought much attention to the Hanford site. *{EPA 1991}*	As presented in the IM/IRA, the landfill has been inactive for over 35 years and the groundwater has been monitored since 1991. The review of this data and including the most recent groundwater data (2003), clearly indicates that the OLF has not impacted the downgradient groundwater quality. Similarly, the review of the surface water data indicates that the OLF is not impacting the water quality of Woman Creek. Section 4.0 of the IM/IRA clearly shows that the OLF is not significantly contaminated. The comparison of this data with the environmental media specific RFCA action levels also indicates that the OLF is not potentially dangerous to human health and the environment. Therefore, based on the limited environmental impact of the OLF, no biointrusion barrier is required as a part of the accelerated action. The cover and buttress toe of the OLF will be monitoring for borrowing animals and corrective action will be taken to move the animals and repair the cover.
	7	There are many contaminants that have been monitored down gradient of the OLF that were not monitored up gradient. This leads one to believe that the OLF is the source of these contaminants. Many of these contaminants are hazardous such as plutonium.	As shown in the IM/IRA, Tables 4-5a and 4-5b, similar to upgradient Woman Creek water quality, several metals, radionuclides, and organic compounds have been detected above background levels within Woman Creek surface water downgradient of the OLF. The concentrations of many of these analytes were occasionally above the surface water ALs (approximately 5 percent or fewer of the observations), and were generally low in magnitude relative to the surface water ALs. Comparing Tables 4-4a and 4-5a, several metals and organics that were detected above background in surface water downgradient of the OLF have not been detected above background in upgradient surface water. However, these

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			analyte concentrations typically were low relative to the surface water ALs, with only infrequent concentrations above the surface water ALs. If these additional detections can be attributed to the OLF, no analyte exceeded its action level more than 7 percent of the time. This frequency of occurrence is not sufficient to indicate the OLF has a significant chronic impact on surface water quality.
	8	There are many contaminants that have been monitored up gradient of the OLF that do not show up down gradient. One can draw the conclusion from this that the waste is beyond the currently assumed boundaries of the OLF.	This assumption is not valid. See response to comment 1 and 7.
	9	Existing conditions reveal areas on the OLF where disturbed areas were seeded and covered with temporary erosion mats. These areas to date have no vegetation established while the temporary erosion mats have begun to deteriorate (see picture below). My concern centers on the idea that the presumed remedy appears similar to this unsuccessful restoration effort.	These areas are either where geotechnical test pitting was conducted or the surface soil contaminated with uranium above the action levels was removed. These areas have not been re-seeded. The erosion mats were placed in these disturbed areas to control erosion pending the construction of the accelerated action.
	10	During the January 14 site visit, the proposed borrow soil site was pointed out by Bob Davis. Some of the materials in the stockpiles appeared to be high in salt content due to its light coloration – possibly elevated levels of calcium carbonate. Soils in semi-arid climates are often high in salt content in soil layers at depth and are generally avoided in landfill covers due to these salts' detrimental affects on plant establishment. Refer to Appendix B for discussion on this topic specific to calcium carbonate. Quality control measures such as those to be enforced at the Rocky Mountain Arsenal can help eliminate problems due to elevated salt concentrations.	The area that is being referred to in this comment is a structure to support some of the operating equipment of the borrow pit. This area is made of concrete blocks and concrete pieces that have inadvertently become partially covered with soil. This area is not representative of the soils that would be removed from the borrow source for the OLF.
		Concerns related to other documents are described below:	
	1	The report titled Integrated Flow and VOC Fate and Transport Modeling for the Original Landfill dated Dec. 2004 contained a very vague summary of modeling performed presumably to justify the low risk remedies chosen for closure of the Old Landfill (OLF). There were no specifics that would facilitate an evaluation of the quality of the modeling performed with regard to input or output parameters; boundary conditions; etc. It was stated that input parameters were based on assumed values. It also stated that there were no sensitivity or	The flow and VOC fate and transport modeling performed for the Original Landfill (OLF) is based on approaches and methodologies described in detail in two previous substantial modeling studies conducted at RFETS; the Site Wide Water Balance study, (KH 2002), and the VOC fate and transport modeling study (KH, 2004). Instead of repeating much of the previous modeling approach/methodology, only the relevant OLF modeling work was simply referenced in the OLF IM/IRA document. Input parameters and boundary conditions specified in the OLF modeling were

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		uncertainty analyses performed. It is difficult to justify a presumed risk analysis stating that the site poses a low risk based on an analysis using presumed values with no sensitivity nor uncertainty analysis combined with the fact that quality control during construction of the planned cover and stability work will be minimal.	consistent with previous well-documented modeling studies. In fact, most of the model input parameter values were determined through previous detailed calibration, sensitivity and uncertainty analyses. Some parameter values were assumed, such as hydraulic properties of the waste material. However, in developing complex flow models such as that developed here, it is common practice to assume values for which data is limited and to then adjust them to improve performance against available calibration information. For the current configuration model, hydraulic parameter values were determined through the previous detailed calibration procedure described in the SWWB modeling (KH, 2002). For closure configuration simulations, some model input parameter values clearly have to be assumed (i.e., fill material hydraulic properties, vegetation distribution, annual growth dynamics, climate conditions, buttress hydraulic properties and buttress drain values). However, most model parameter values were determined through previous modeling work (KH, 2002), and as stated in the report, an attempt was made to use conservative parameter values. Typical modeling practice does involve performing sensitivity and uncertainty analyses to identify key parameters controlling system response and to assess uncertainty in model predictions. However, previous site-wide uncertainty and sensitivity modeling, reasonable results from localized calibration of the OLF area, combined with assuming conservative parameter values and climate conditions, likely produce conservative estimates for high groundwater levels and seep areas.
	2	The Geotechnical Investigation Phase 3 Stability Analysis Technical Support Memorandum dated Dec. 2004 provided a general characterization of the boreholes dug along with shear strength and friction angles. There was no evaluation of soil hydraulic properties contained. The stability analysis performed appeared to be very thorough and well summarized. In general, I agree with the methods used, but not necessarily with the conclusions. The acceleration used (0.06 g) appears low based on such references as UCRL15910 (Appendix A) that has specific accelerations recommended for the Rocky Flats site depending on the annual probability of exceedance or risk category. Furthermore, the pseudo static analysis performed produced factors of safety less than 1.0.	This investigation at the OLF was intended to determine strength parameters for the materials associated with, and underlying, the Original Landfill. An evaluation of the soil hydraulic properties (hydraulic conductivity, ect...) was not in the scope of this investigation. Soil strengths assigned in the analysis are the same for saturated and unsaturated conditions, based on saturated conditions established during laboratory testing (laboratory testing results were obtain from saturated soils). The seismic stability analysis methodology has been discussed in numerous meeting, and is consistent with industry standards and appropriate guidance documents. The acceleration of 0.6g represents one half of the peak acceleration generated from the design earthquake event. If the factor of safety in this analysis drops below 1.0, and more detailed deformational analysis is conducted. This analysis generates the maximum permanent displacement that can be expected, and this displacement is compared to

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			the criteria of less than twelve inches.
	3	The stability analysis does not take into account some of the difficulties presented by groundwater and hydrostatic forces. The buttress that is recommended in the stability analysis makes no mention of its location with respect to the flood plain associated with Woman Creek. Because the contaminants of concern have long lives one would assume that the associated flood plain would accommodate this (i.e. 100 year flood plain or greater). If the toe of the soil buttress were located in the floodplain which appears likely given the sketches provided, the elevated water levels would erode the toe of the buttress thus reducing the effectiveness of that buttress. {40CFR258.20}	Soil strengths assigned in the analysis are the same for saturated and unsaturated conditions, based on saturated conditions established during laboratory testing (laboratory testing results were obtain from saturated soils). The potential impact of floodwater saturating the buttress soils is accounted for in the stability analysis. The final design will evaluated protection of the buttress required do to erosion and scour issues associated with flood plain waters.
	4	The provided sketch of post-closure groundwater monitoring wells does not appear to enable a monitoring effort that takes into account the significant uncertainties at the site, such as the widespread contamination monitored, potential ill-defined landfill boundaries, uncertainty of types and amounts of waste contained in the OLF, and uncertainty of the effectiveness of the presumed remedy. A more frequent monitoring period such as quarterly and after each significant event (i.e., a fire or severe thunderstorm that could cause erosion damage or seismic event that could lead to stability failure) would better enable timely data collection in case of an unsuspected problem that may occur. This monitoring frequency should remain consistent until the CERCLA five-year review period that can be used to adjust the type and frequency of monitoring if necessary. {40CFR258.50}	Groundwater, surface water and physical monitoring of the OLF after the implementation of the accelerated action will be conducted by the DOE and is outlined in the IM/IRA. Groundwater and surface water sampling locations will be added to the IM/IRA. Section 10 of the IM/IRA will become an appendix and include both groundwater and surface water monitoring locations. These locations will be incorporated into the IMP and post accelerated action monitoring plans. A post accelerated action maintenance and monitoring plan will be developed as a part of the final design that will specifically define the inspection, monitoring & reporting of the conditions at the landfill after the accelerated action has been constructed. The monitoring frequency is consistent with the CERCLA five-year review period as presented in the IM/IRA.

Admin Record Master Entry (FISF_AR_ADMIN_RECORD)

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IA	A	002617	03/10/2005		300	YES, ROUTINE	PRELIM

Print

Title: Final IM/IRA for Original Landfill IHSS Group SW-2, IHSS 115 and IHSS 196

Internal Code: 00146-RF-05; 05-DOE-00157; [002579]

Rev No

Tag

Document Type: REPORT / STUDY / PLAN

Date Received: 03/26/2005

Login Date: 06/13/2005

Login By: HY

Data Entry Date: 06/13/2005

Indexer: HY

Create Date: 06/13/2005

By User: N711573

Last Modified: 09/26/2005

By User: N711573

Receipt Type: C

Under Review:

Prelim History:

Public History:

Core A/R Document?:

Title/Subject Acronym

The Final Interim Measures / Interim Remedial Action (IM/IRA), for the Original Landfill, including Individual Hazardous Substance Site IHSS Group SW-2; consists of two IHSSs: IHSS 115, Original Landfill (OLF), and IHSS 196, the Filter Backwash Pond.

Comments Acronym

See copy under AR IA-A-002579 Final IM/IRA for the Original Landfill IHSS 115. I CD attached to documents.